NOVEMBER 1967 35 CENTS

Popular Science

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AN LAST
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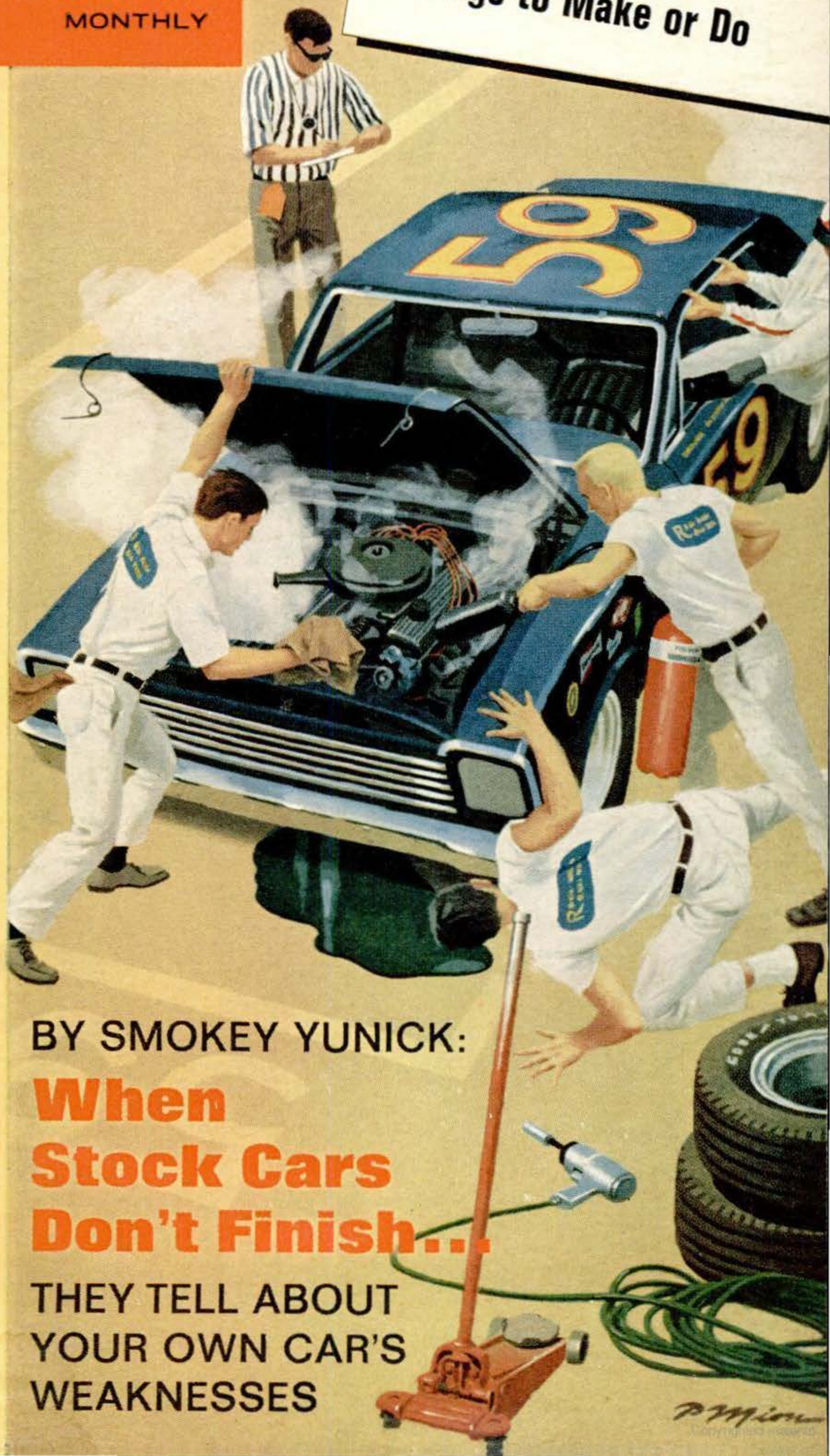
GIANT WINTER WORKSHOP

79 Good Ideas for Things to Make or Do



BY SMOKEY YUNICK:

When Stock Cars Don't Finish...

THEY TELL ABOUT YOUR OWN CAR'S WEAKNESSES

Oneida...the boot that took Antarctic punishment in stride

Glacier-hopping on perilous Heard Island, this explorer wears Oneida for warmth, safety, comfort.

You probably won't ever sail a small vessel through sub-antarctic waters to a treacherous, weather-blasted island and climb to the summit of a storm-swept volcano.

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Look for the Red Ball by Ball-Band, Mishawaka, Indiana

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THIS IS WHAT HAPPENED WHEN
JAMES A. KOLLAR READ ABOUT THE SNOWMOBILE
IN POPULAR SCIENCE MONTHLY.

He bought it. And loaded his family into it. And let us take this photograph.

One reason Mr. Kollar purchased this Snowmobile is simply that he's the kind of man who can buy what he sees and fancies. (He's Chief Partner of a prosperous engineering firm in Michigan.)

Another reason he bought it: Jim Kollar - an automotive engineer - has confidence in Popular Science, to which he subscribes. "It's very accurate," he says. "It keeps well abreast of developments. I read Popular Science regularly. It is well illustrated and written for easy reading. I like the way Popular Science is put together."

So do 7,000,000 other readers. And, like Jim Kollar, they represent a prime market -- better educated men, with better jobs and bigger incomes than any other audience in the field.

Also like Jim Kollar, there's a good chance that these men will be buying something they see in this issue. Or the next one.

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Cordially,

Charles S. Thorn

Charles S. Thorn
Executive Vice President
Advertising Sales

SP-1

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November, 1967

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Beard's-eye view of the closest shaver on wheels.

This is what it feels like to be a whisker about to get a close, fast, comfortable Tripleheader shave.

Don't be scared.

Even though this Norelco shaves so close we dare match it with a blade, there's not a pull, not a pinch, not a nick. And those three round discs? Those are Norelco Microgroove™ heads. Shaved down even thinner than this magazine page. For a 35% closer Norelco shave.

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And there are some things you can't see in this picture. A pop-up trimmer. 110/220 voltage selector. On/off switch. Snap-off cleaning. More shaving features than any other shaver on the market.

You get all of these things in the Norelco Tripleheader Speedshaver® 35T. And you get all of them with the new Norelco Tripleheader Rechargeable 45CT (the rechargeable that packs twice as many shaves per charge as any other. Works with or without a cord, too.)

Want to put on a happy face tomorrow morning? You can't come closer than this.

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The close, fast, comfortable electric shave

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NOVEMBER 1967 Founded in 1872/Vol. 191 No. 5

HIGHLIGHTS OF THIS ISSUE:

When Stock Cars Don't Finish. . . BY SMOKEY YUNICK PAGE 65
. . . they tell about your own car's weaknesses. Smokey gives you the inside story of stock-car failures—and explains their significance to you.

Assassination of a President: Could It Happen Again? PAGE 70
PS exclusive: How the Secret Service uses technology to guard the President.

Your Teeth Can Last a Lifetime BY LAWRENCE GALTON PAGE 76
New dentifrices and inoculations, plus a plastic coating, may put an end to cavities.

Facts and Figures on the '68 Cars PAGE 92
How do the new cars compare? See for yourself in these complete PS spec charts.

Winter Workshop Section PAGE 113
Count 'em—79 Good Ideas to keep you busy all winter long. Want to build a canoe, or a buffet-dining table? Pour a fireplace? Automate your garage door? Here's how. Plus ideas for boaters, photographers, machinists, home owners. And lots more.

COVER PAINTING BY PIERRE MION

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COMING NEXT MONTH

We don't want to give away all the surprises in December PS—but here's a sneak preview:

- Erle Stanley Gardner tells you about the remarkable new non-lethal weapons—some already in use; some on the way—that will enable police to control rioters, or even desperate criminals, without endangering the lives of innocent citizens.
- A skilled "odometer artist"—the guy who turns back the mileage on used cars—writes (anonymously) about this widespread practice that not only cheats you out of dollars but can kill you if you wrongly believe you're driving a low-mileage car . . . With a few tips on how you can avoid being duped.
- PS' dare-anything reporter Bob Gannon takes an LSD "trip" in the interests of science.
- Norbye/Dunne Report: Test-Driving the '68 Chevelle, Belvedere, Rebel.
- PS Blueprint Project: A Coffee Table with Storage Space . . . and a great deal more.

On sale November 28.

AUTO UPKEEP

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Boy, have you got it made.

(Girls with pimples have to mess with 73 different medications to find one that works.)

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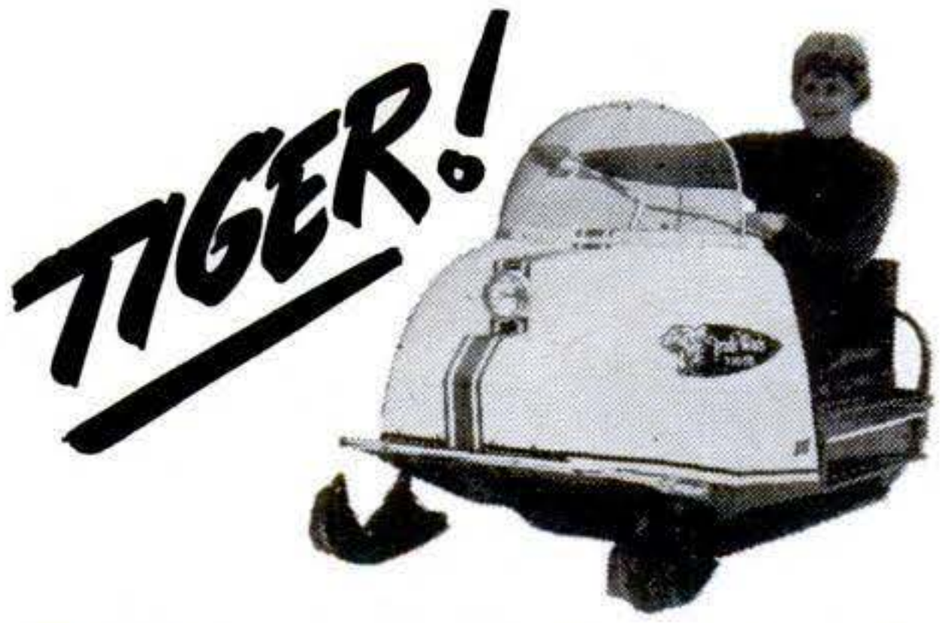

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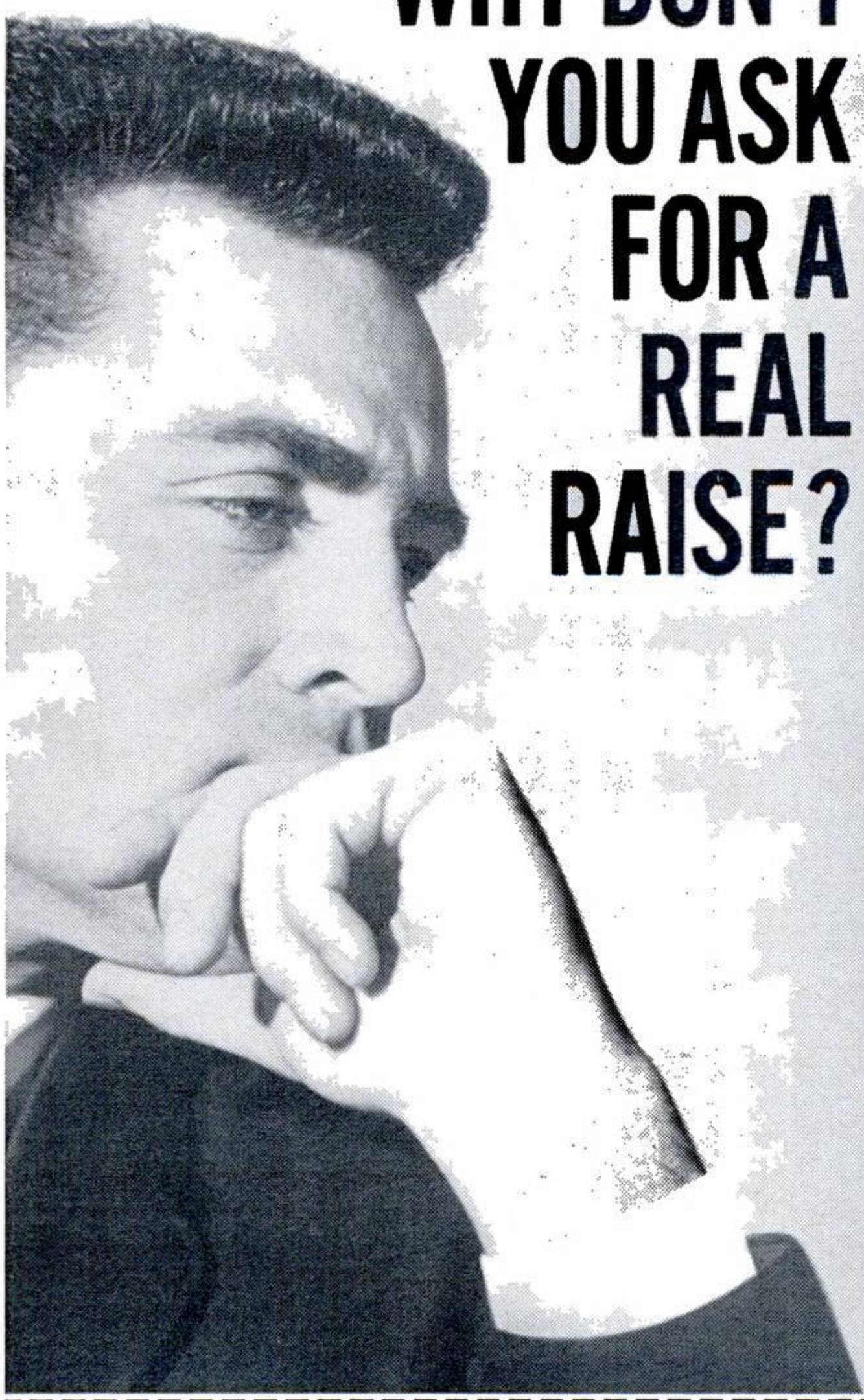

WHY DON'T YOU ASK FOR A REAL RAISE?

Think you may be turned down? Here's how ambitious men get important promotions without even having to ask.

If it's been a long time since you've celebrated a raise in salary, ask yourself why. Are you really worth more money? If you're not sure, look again at men who have moved ahead...men so clearly marked for promotion that when it came it was just what everyone expected.

How did they do it? The most usual answer: *through special training.* Special training is the direct way to increase your personal value, your income, your rate of advancement. Soon other employers are likely to seek you out — because *many important positions today are going begging for lack of qualified people to fill them.*

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Name.....Age.....

Address.....County.....

City & State.....Zip No.....

Occupation.....Working Hours....A.M.....P.M.

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PS Readers Talk Back

A novel safety tip

The usual safe distance between autos in traffic is considered to be 10 feet for every 10 miles of speed—60 feet for 60 m.p.h. My method is to keep a one-second interval between me and the car in front. You can estimate one second by counting silently "one hippopotamus, two hippopotamuses" —allowing one second per hippopotamus. Mark or notice a spot the auto ahead of you has just passed and begin your count of "one hippopotamus, two hippopotamuses" until your auto passes the same spot. I have found that a whole hippopotamus time interval is about right for me. Half a hippopotamus is too close for comfort.

DONALD L. WEST, Palo Alto, Calif.

How fast can a hippopotamus stop?

Bravo for NSU's twin-rotor Wankel

"NSU's Twin-Rotor Wankel-Powered Sedan" [Sept.] rates another "bravo." First it was the single-rotor NSU Spider, then the dual-rotor Cosmo (0-60 in 8.7 seconds from 60 cubic inches), and now the Wankel sedan (0-60 in 12.2 seconds from 60.7 cubic inches). It's really too bad Detroit is still too concerned with labor troubles, simulated wire wheels, rubber bumpers, and optional this and thats, to get down to real engineering and take a step forward.

ROBERT C. DIETRICK, Freeport, N. Y.

The Henry Ford Museum

The POPULAR SCIENCE "Map and Guide to the U.S." by Lowell Thomas [June] did a very good job. But we would like to call your attention to the fact that the Henry Ford Museum and Greenfield Village are more than just an old-car museum, as they are listed in the article. We have an outstanding collection of aviation items, locomotives, horse-drawn vehicles, and agricultural equipment in the transportation area. We also have one of the finest and largest collections of American decorative arts in home furnishings to be found anywhere.

JAMES E. JONES, Manager, Press Relations, The Henry Ford Museum and Greenfield Village, Dearborn, Mich.

Computer story needs a new input

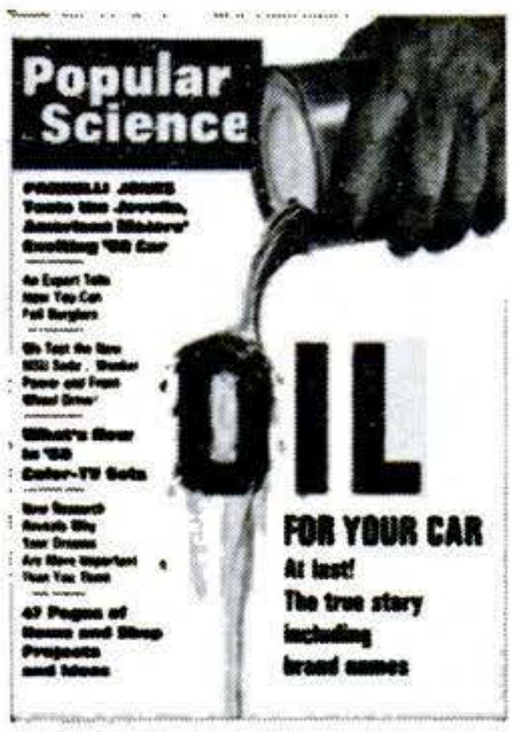
Your article "The Computer Revolution Wants You" [Sept.] says the computer companies are "the only companies that employ customer engineers and train everyone who works for them." The data-processing industry has gone through dramatic changes in the past five years. We do not manufacture DP equipment; however, we are one of the largest companies that lease IBM equipment, and we employ well over 1,000 customer engineers to service this equipment.

A. M. COSENTINE, Vice President, MAI Equipment Corp., NYC

Parnelli Jones on smoking

I was amazed at Parnelli Jones' comment on his preference for vent windows in front doors ["Javelin SST: An Exciting New Sportster for '68," Sept.]. He stated "they are perfect for a smoker to flick the ashes out." Here on the West Coast with our beautiful and valuable forests, thousands of dollars are expended in educating motorists to use their ashtrays. Champion drivers are considered safety experts and looked up to by most drivers. I think the statement on the use of vent windows was careless.

DAVE GUTHMANN, Tacoma, Wash.



Gushing over oil for your car

"Oil for Your Car" [Sept.] brought out many useful facts that will aid the car owner in selecting the best oil. Oil additives were broken into classes to distinguish them by their uses. Many people, myself included, probably never knew these additives existed. Keep the good articles coming.

G. DAVID, Dickson City, Pa.

. . . The oil article is excellent for experts, but leaves me like the cross-eyed man at the beauty contest. What is the average

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PS Readers Talk Back

[*Continued*]

car owner to do? Fleet operators keep accurate records of car costs per mile. They have found it generally true that the fleet that spends most for lubricating costs per mile also spends the least for total operating costs per mile—the more important figure.

With modern engines, the percentage of oil costs to total operating cost is such a small factor (often less than three percent) that it will pay the car owner to follow the instructions in the owner's manual as to oil type, and give the benefit of the doubt to more frequent oil changes rather than, as so many car owners have a tendency to do, changing less frequently and hoping for the best.

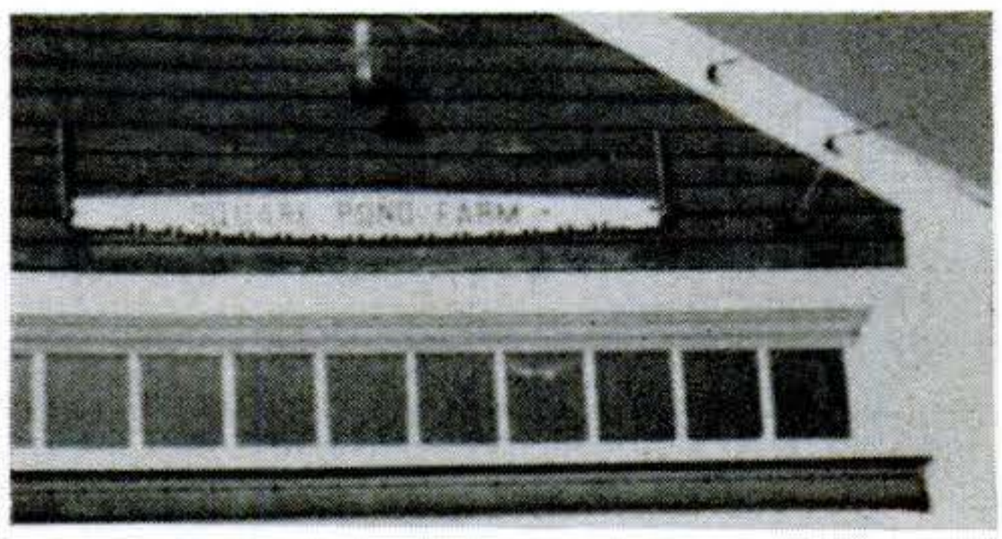
MURRAY FAHNESTOCK, Pittsburgh, Pa.

. . . Congratulations on your motor-oil article. It was deserving of the attention your cover commanded.

DICK WAGNER, Springfield, Pa.

Sign of changing times

Don't throw away those old crosscut saws. Nobody uses them any more because chain saws are a lot less work, but as you can see



by this photo, the saw makes an attractive sign on my barn—a novel decorative item around a homestead.

THEODORE N. FERREN, Acton, Maine.

Assist in holding router work

In using my router, I find it very difficult to hold the stock secure. Your article "19 Smart Tricks with a Router" [July] does not explain how to do this either. Is there no method of safely holding the stock to the bench, without damaging the stock? If you have found a satisfactory method of securing the stock, I am sure many readers would appreciate hearing about it.

W. G. KAUFHOLD, Pompton Plains, N.J.

When you can't or don't wish to use clamps, make a rough and simple frame from scrap metal, thinner than the workpiece. Tack-nail this to the workbench so the stock is held securely and isn't marred.

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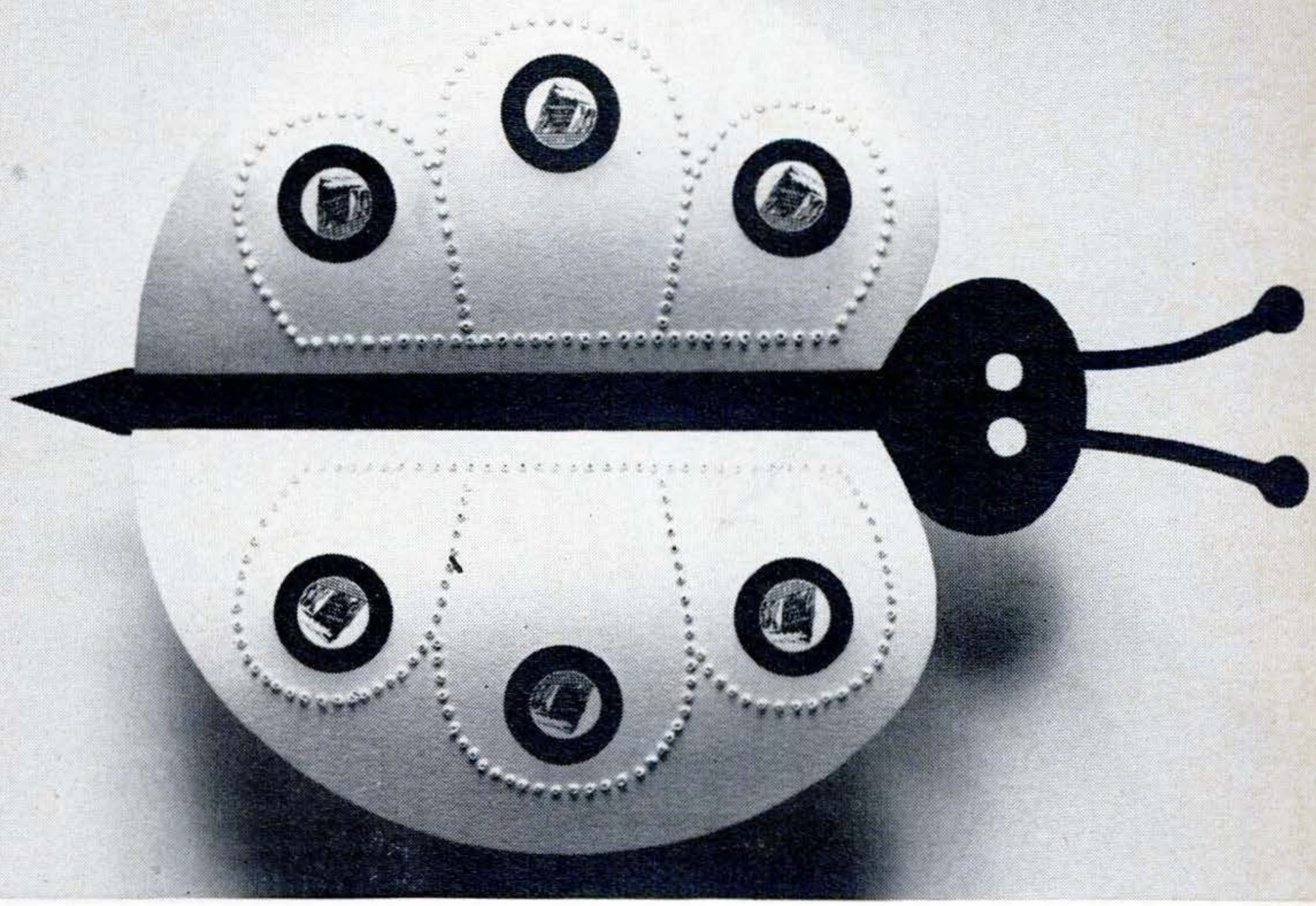
You don't want to be bugged about life insurance. It's something you can live without.

But could your family?



Prudential understands that you can rationalize your way out of almost everything. But not your family's need for insurance.

As an experienced bill-paying father, you know how much it takes each month to keep the home going. Whatever it takes, Prudential's "continuing income" insurance can provide. If you are taken out of the picture, your family would still have enough clothes, good home cooking, and a place of their own.

Of course, with Prudential's "continuing income" insurance, you're not just being noble—you're being smart. As you pay the premiums, this insurance builds a cash reserve you can draw on for a mortgage down-payment, education, and eventually for retirement.

Your Prudential man can show you how easily Prudential's "continuing income" insurance will fit with your income. When it comes to squeezing the most protection out of a young familyman's dollars, **Prudential understands.**

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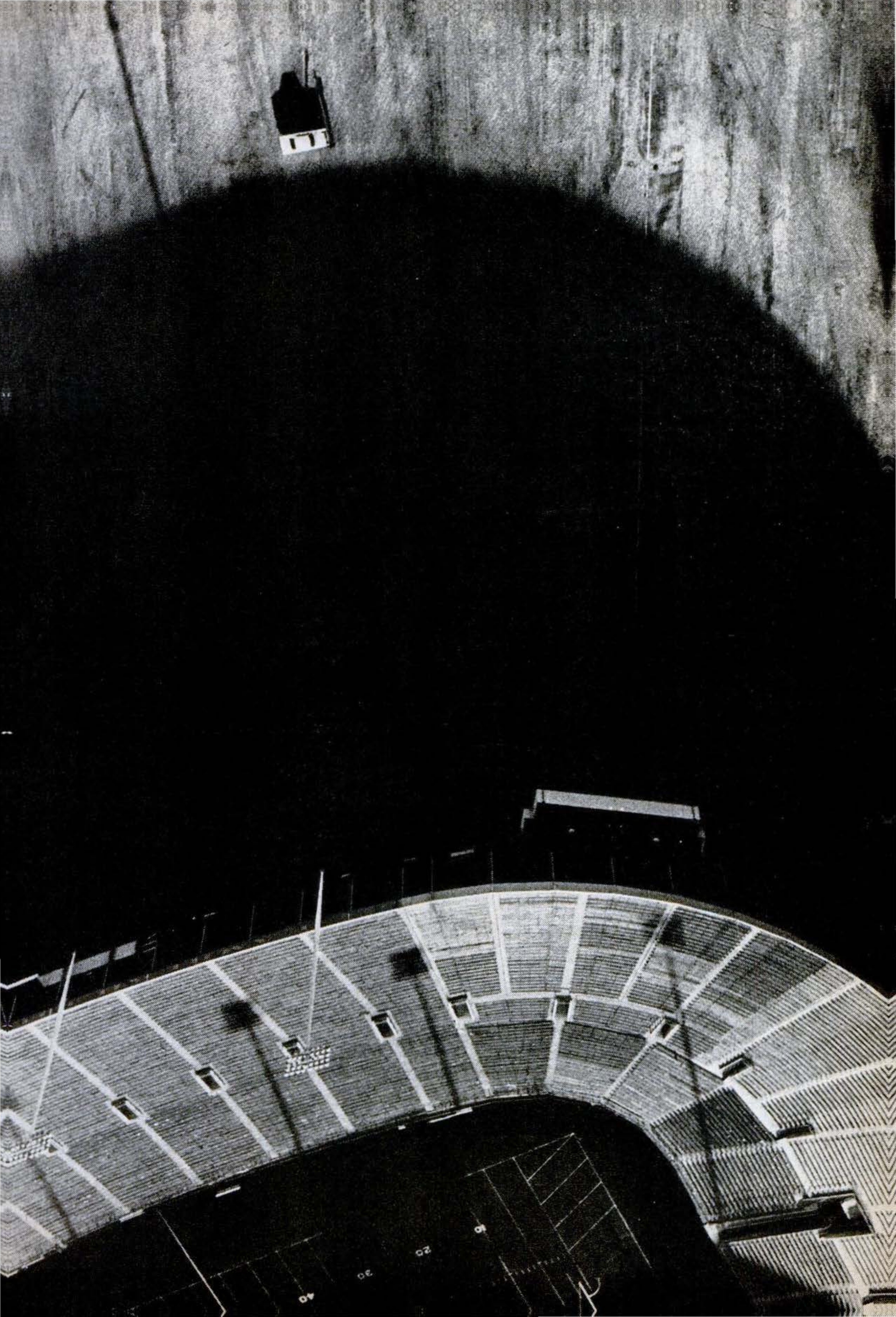

Now don't you wish you had the DieHard?™

She started up just fine this morning. This afternoon . . . clunk.

Somewhere back there, there must be a pay phone. And if you had a dime you could probably find a mechanic who wouldn't charge a right arm to get you rolling.

Buying Sears new DieHard yesterday would have solved everything.

If only you'd known. A dying battery can tell you when it's about to give up the ghost, but you have to pay attention.

If your battery has 25,000 miles on it, it may be later than you think.

Palpitation of the lights is usually another bad sign. Bright when you race the engine, dim when you let up.

Or your car seems a little stiff in the joints on cool mornings, and takes just a little bit longer to fire up.

You'll have to watch for these warnings with your new DieHard eventually.

But it's guaranteed for five years.

You see the DieHard is the most powerful car battery of its size in America. Its secret is in its case. Thinner walls of polypropylene replace thick walls of hard rubber. So, with the same outside dimensions, literally there's more room inside—for more acid and bigger plates. These are the things that let the DieHard store more power, give more power.

If you're worried about those thinner walls, don't be. The DieHard's new polypropylene case is actually 6 times stronger than standard battery cases at room temperature.

We know that batteries don't always wait until payday to die, so you can charge the DieHard on your Sears Revolving Charge at any one of over 2000 Sears, Roebuck and Co. stores.

The Sears 5-year guarantee:
"Free replacement within 90 days of purchase if battery proves defective. After 90 days we replace the battery, if defective, and charge you only for the period of ownership, based on the regular price less trade-in at the time of return, prorated over number of months of guarantee."

The DieHard
America's most powerful car battery
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The DieHard is so new it's available in Group 24 only. This size fits most Chevrolets, Chryslers, Dodges, Plymouths, Studebakers, many Oldsmobiles and Pontiacs, all Ramblers and Willys. Soon it will be available in all popular sizes. Sears carries a complete line of other fine batteries as well, in a wide range of prices.

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BUT what you get out of it could change your whole outlook on life

See all we have in store for you on the 1968 Johnson Range—great new ways to escape everyday tensions, to make the most of your leisure hours outdoors. The broadest assortment of recreational idea-products ever offered the public. New Sea-Horse motors (20 models, 1½ to 100 hp, including the revolutionary new 3-cyl. 55). New Sea-Foil stern-drive boats (4 in all, 14′ to 19′, with a new open-decker, Seasport II). New Air-Buoy surface-air-supply for underwater swimming. New snowmobiles (3 light, quick, quiet models, including 2 with reverse-gear).

It takes 40 full-color pages to cover our '68 Range—the greatest line of fun machines ever developed to give you a new outlook on life. MAIL COUPON FOR YOUR FREE COPY OF OUR BOOK!

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Send me your book on the 1968 Johnson Range. I'm especially interested in ___ outboard motors, ___ stern-drive boats, ___ underwater swimming, ___ snowmobiles.

name_____

address_____

city_____ state_____ zip_____

PS Readers Talk Back

[*Continued*]

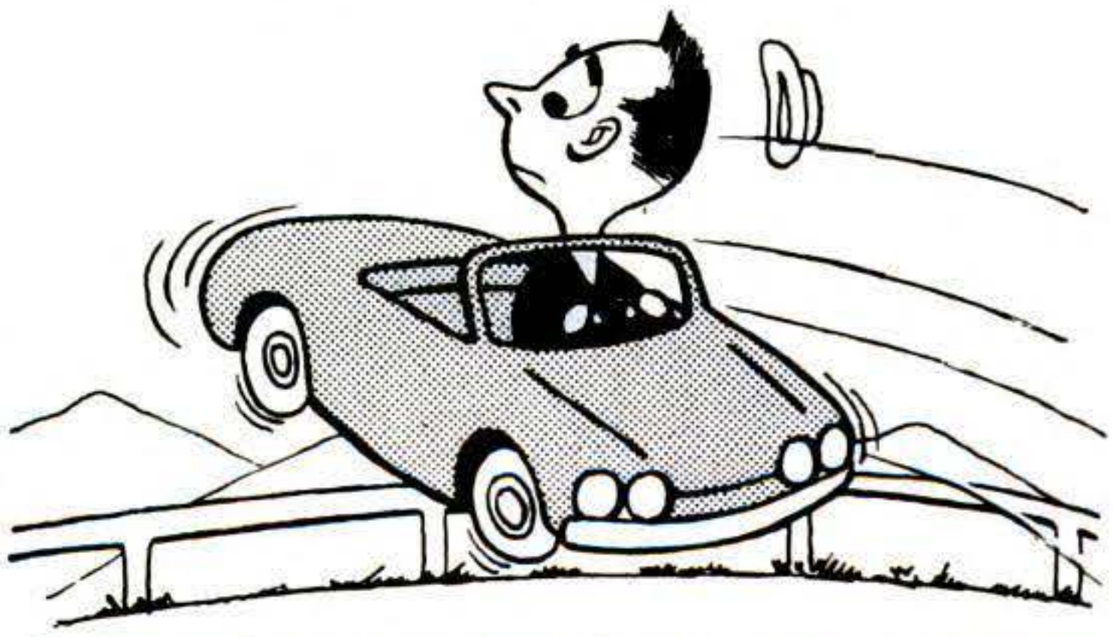
You can also use steel bar stock as a weight to hold down stock being routed. Keep the steel smooth and clean so it can't harm the work.

Mixing snows and radials

Your reply to Robert Picorelli in "Readers Talk Back" [Sept.], saying it's okay to mix radial-ply and snow tires is wrong. It is not okay to leave radials on front and put regular snows on the rear. My Peugeot 404 with Michelin X in front and snows on back was virtually unmanageable.

LEWIS L. FISHER, Pleasantville, N. Y.

. . . You should not put two radial-ply tires on the front if snow tires are fitted on the rear—unless you want to go off the road



backwards at the first bend. The Michelin Tire Co. will support me on this. I have driven many miles on radials. Now that I have accepted their peculiarities, their stickability, especially in rain, and their long life are two factors which have endeared them to me.

MICHAEL G. MATTHEWS, Falls Church, Va.

Carburetor adjustments

It is common practice to adjust idle mixture first, then idle speed. Your system ["How to Clean and Adjust Your Carburetor," Sept.] of adjusting speed first and then mixture might leave idle speed outside desirable range, or require another idle-speed adjustment. The most foolproof system for adjusting idle mixture is to use a vacuum gauge and adjust for maximum manifold vacuum, which is most efficient engine operation.

CHARLES LOENSER, Lakewood, N. J.

PS did not reverse the adjustment order. It's good practice to go back and adjust idling speed.

Want to get something off your chest? Write "Readers Talk Back," POPULAR SCIENCE, 355 Lexington Ave., New York, N.Y. 10017.

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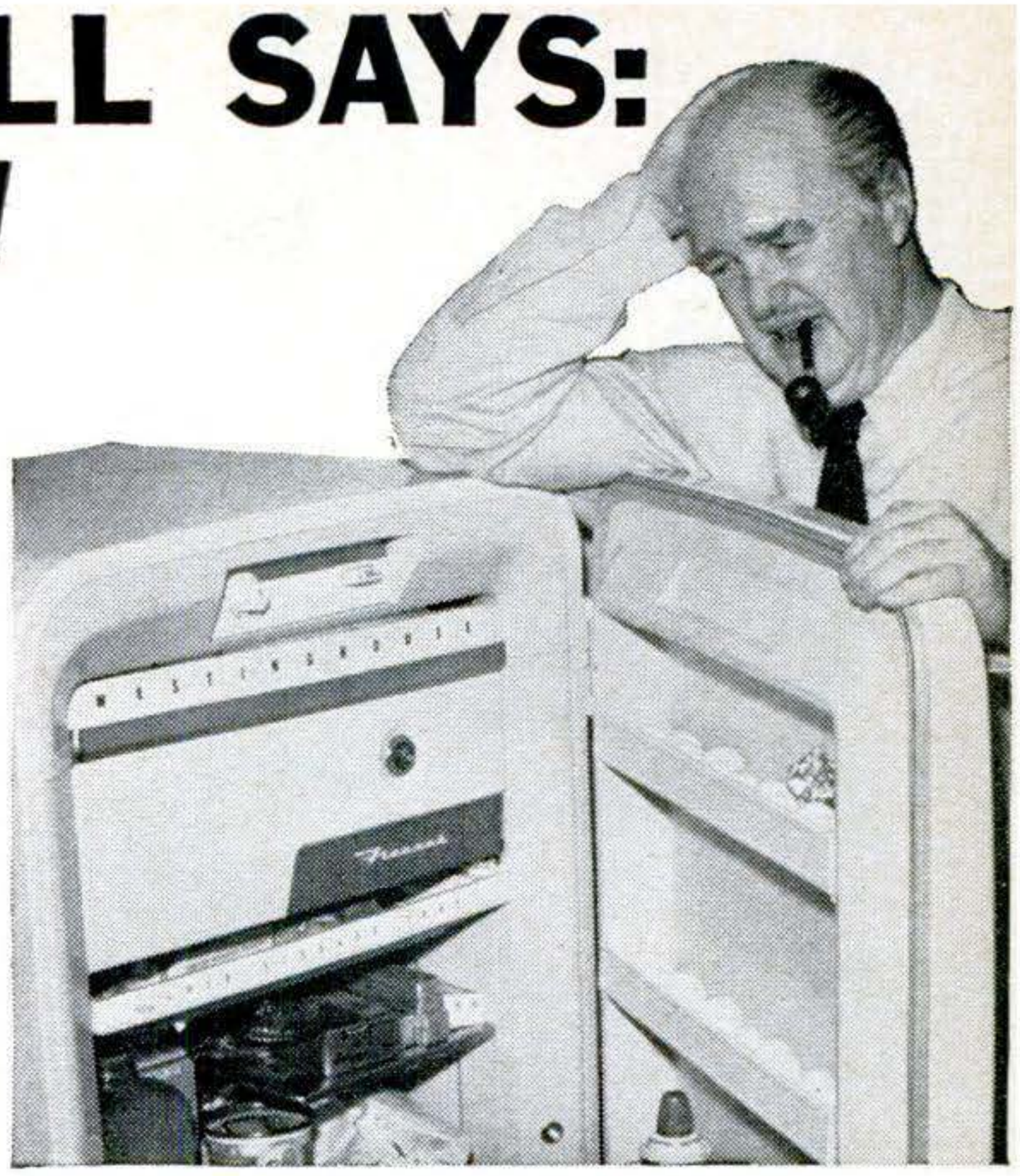
TOM McCAHILL SAYS:

"There's COLD CASH In Repairing These Things!"



Each time a buddy of mine moans about the lousy repair job he got on his refrigerator or toaster or washing machine, I'm reminded of the fact that a good Appliance repairman is a mighty rare breed these days.

This neighbor of mine had refrigerator trouble just last month, and needed some speedy repair service. After phoning half a dozen repairmen who were booked solid for days, he finally had to settle for a bum job from a guy who had no business calling himself an Appliance repairman. This brings me to an important point. No one who wants to earn money in Appliance repair needs to learn by trial and error. There's a great, low-cost home study plan on the market that covers every type of Appliance repair in detail. The course was prepared by the Appliance Division of the National Radio Institute, one of the biggest and best schools in the field. Thousands of guys like yourself have studied with NRI, and many of them have more than paid for the low tuition fee within their first couple months servicing Electric Appliances.

If you want to make money (and who doesn't) in a field that's crying for good talent, make certain you send for a free NRI catalog. Get the details on the well-illustrated lessons that teach you how to repair home, farm and commercial Appliances, and small gasoline engines. You'll be amazed at how little the training costs. And you'll even get a professional Appliance Tester without extra cost.

NRI has been in the home study field since 1914, and they have a staff of 150 experts in Washington, D.C., who guide you through the course with more personal attention than you'd fine in some classrooms. If you're really out to learn, they can furnish a special course in air-conditioning and refrigeration repair, too.

Even if you've never tried to put a toaster in working order, even if your schooling never went beyond the tenth grade, I'm as certain as my name is McCahill that you can make money in the Appliance repair field with the help of this NRI course.

Do yourself a favor right now. Send off the coupon below and NRI will send you a free catalog. If you don't like the looks of this material, you can forget the entire deal, and you'll be out only one postage stamp. But remember, the Appliance repair field needs qualified men *now*. And you can qualify with NRI training.

Tom McCahill

P. S. NRI won't send a representative to call on you. They've never needed any with this great course!

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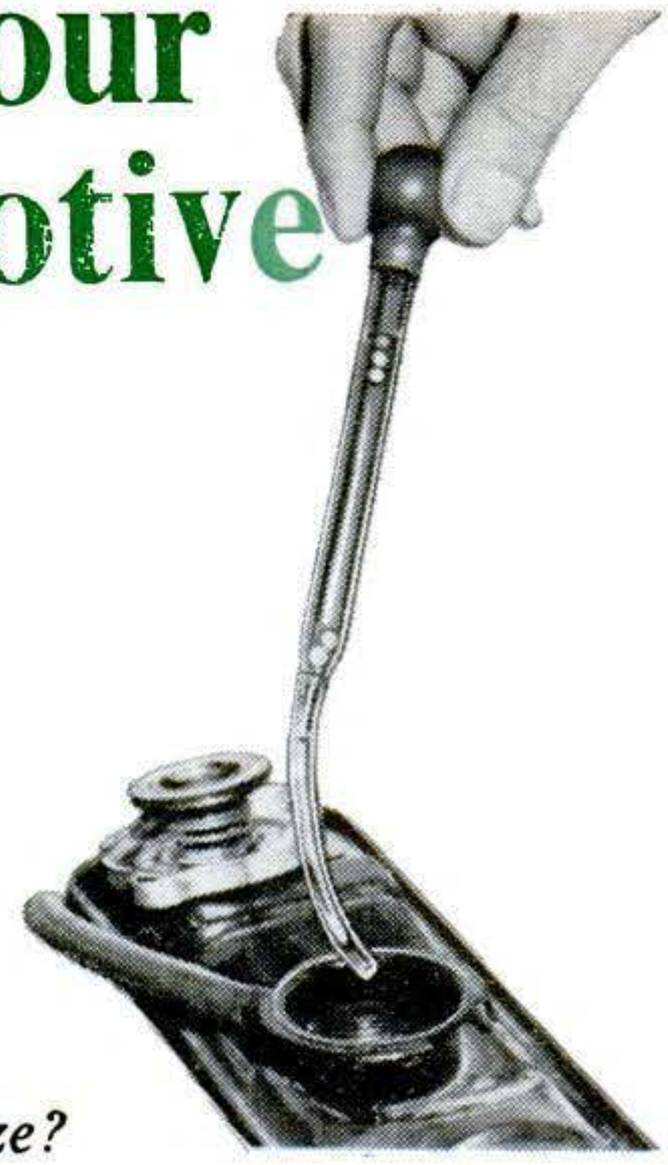
Test your automotive I.Q.



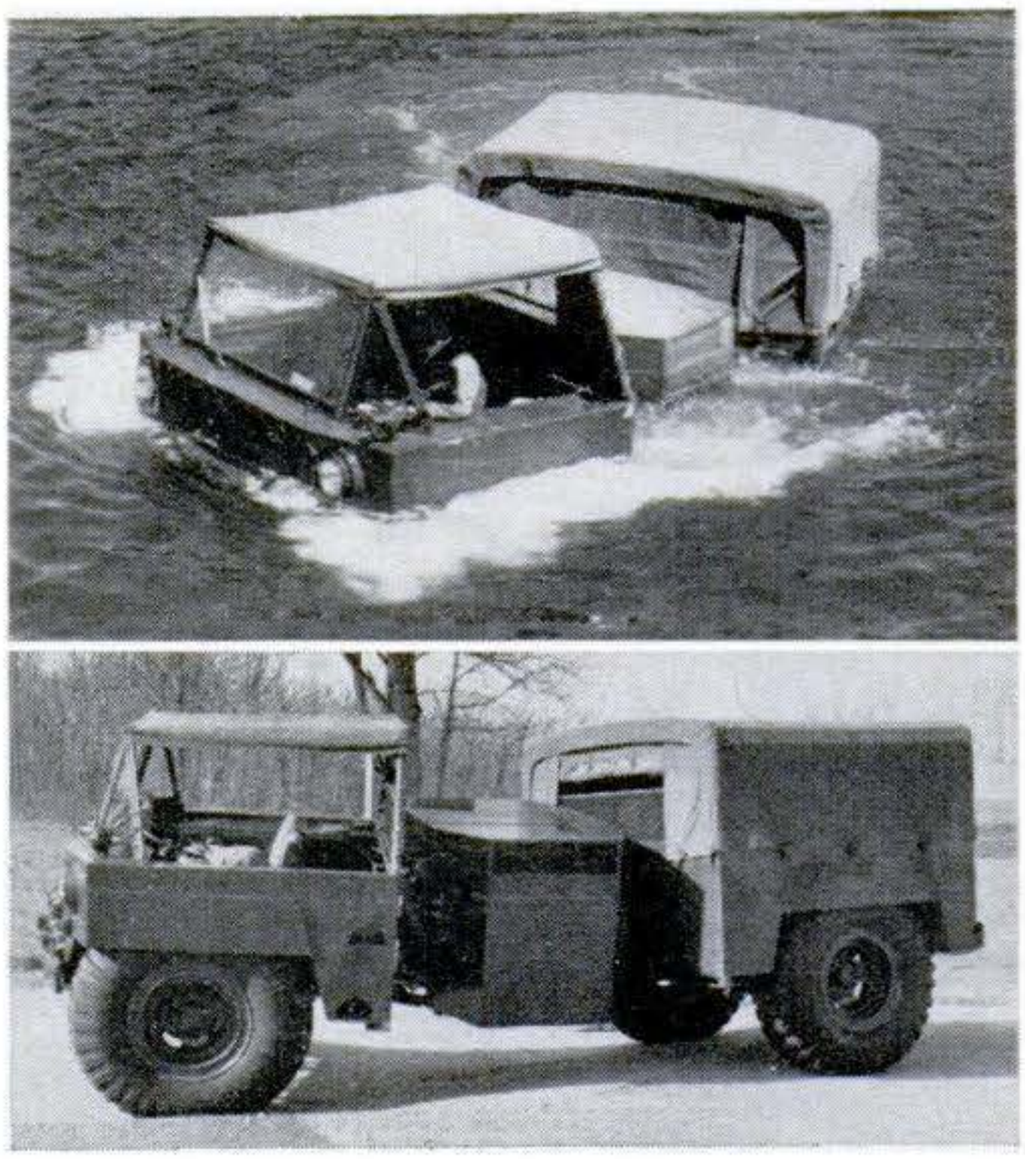
This is a pocket size?

What does this symbol stand for?

An anti-freeze tester that checks accurately to 40 below zero. The symbol stands for the best engine life preserver you can buy: Quaker State Motor Oil. It is refined from 100% Pure Pennsylvania — the world's choicest crude oil. It keeps your car on the go, out of the repair shop, and saves you money. Always ask for Quaker State Motor Oil by name—it keeps your car running young.

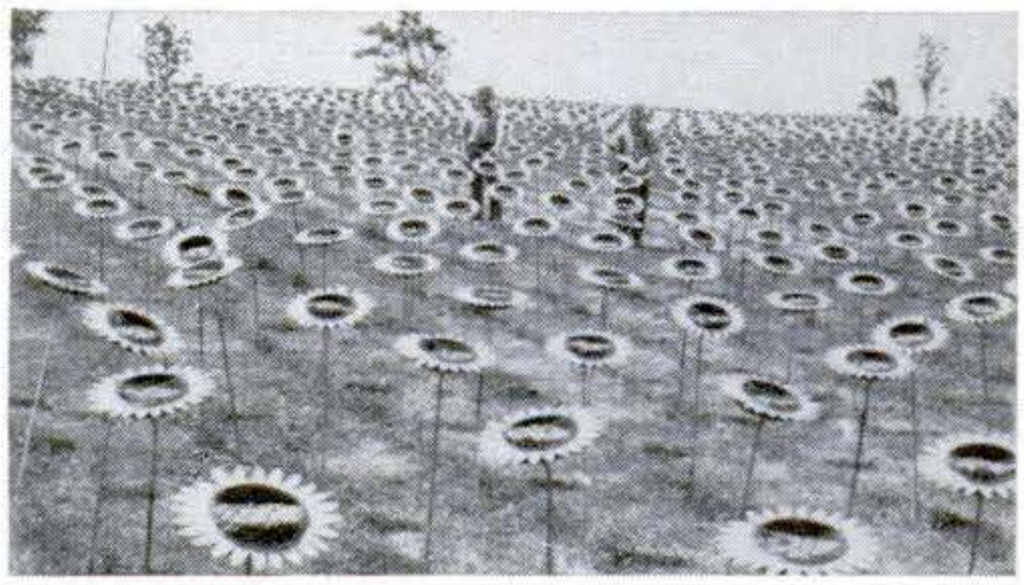
Quaker State Oil Refining Corporation
Oil City, Pennsylvania

PS PICTURE NEWS



New twist in Army vehicles

This double-jointed amphibian uses four-wheel drive to swim or drive across rugged terrain. Officially known as TASC (Tactical Articulated Swimmable Carrier), the amphibian maintains wheel-to-ground contact over rugged terrain through its flexible sections. It can even climb 21-inch walls and keep going. Watertight construction lets the vehicle swim (above) with 11 inches of freeboard. The amphibian, built by Chevrolet, has a 283-cu.-in. V-8 engine and Powerglide automatic transmission. Engine and transmission are located side by side in the center segment. Final drive is through a two-speed transfer case. There are caliper-type disk brakes on front and rear axles.



Smorgasbord for the birds

The "sunflowers" pictured above are for the birds—literally. Artificial, they are filled with sunflower seed—relished by cardinals—in a garden at Griggsville, Ill. The birds eat more than a ton of seed, supplied by bird lovers, each winter.

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You'll never know how good our torch is until you pick up theirs.

The Ronson torch can do anything theirs can do. Plus some. Since ours is almost seven inches shorter, it lets you work in tighter quarters. For example, you have the knuckle room to defrost a freezer.

Our torch weighs under 12 ounces, instead of almost 2¾ pounds. The difference really becomes noticeable when you are loosening an overhead pipe in the basement.

Our torch fits in a toolbox. When you want it you know where it is. (You'll be amazed how many uses you'll discover for a torch when it's lying in the midst of your wrenches and screwdrivers and other household tools.)

Our torch has a self-cleaning head. Adjusting the flame to low cleans it. Theirs runs on propane, it can clog. When that happens you have to use a pin (which they thoughtfully supply) to clean it. But what happens if you lose the pin?

Our torch uses half as much fuel as theirs when you turn it up to a 1½" flame. (That's a commonly used flame setting.) We borrowed a trick or two from our butane pocket lighter experience to give you this economy.

Our dial for adjusting the flame is simple. We put in some "give" like car-makers put in their steering wheels. When you turn the flame down to pin-point size, it doesn't go off.

Our fuel supply is available everywhere. You can buy a Ronson Multi-Fill® Butane injector in candy stores, drug stores, tobacco stores, even department stores. It's easy to find when you need a new fuel supply. Suggested retail price. $4.95

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The people who keep improving flame.
Ronson professional type torch kits from $8.95

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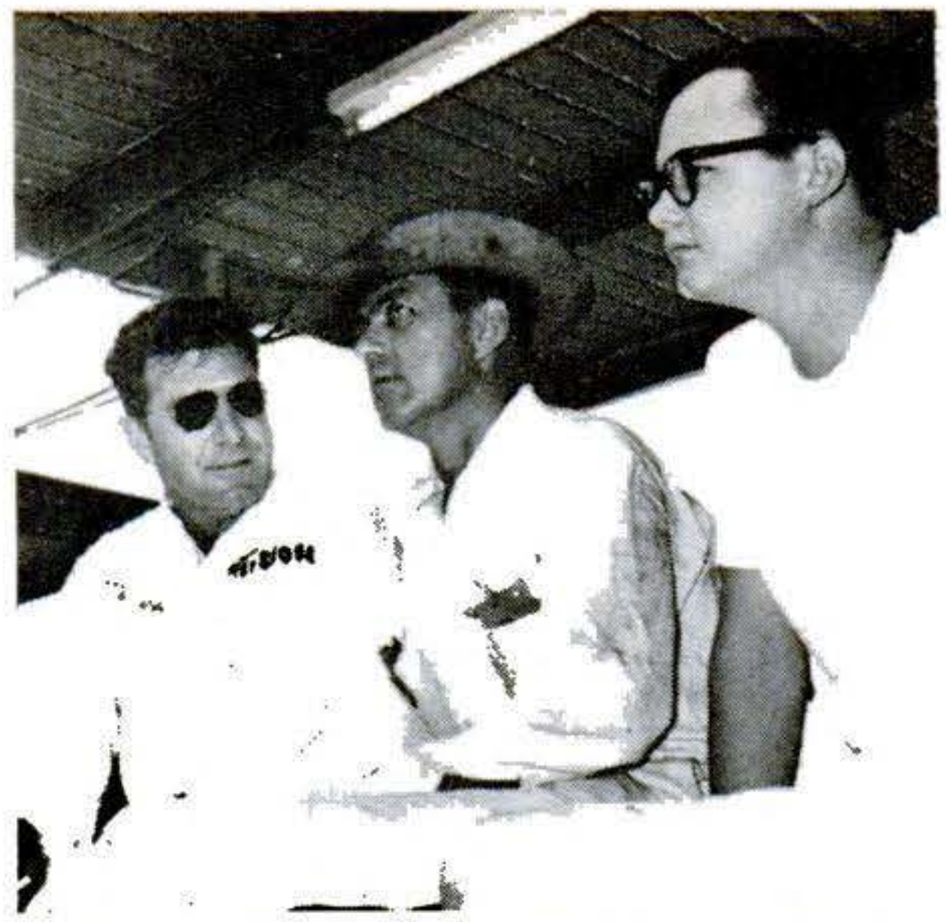
"Say, Smokey—"

A clinic on cars by America's most famous mechanic

Each month in POPULAR SCIENCE Smokey Yunick answers questions on cars—family cars, high-performance jobs, hot rods, and racing cars—selected from those sent in by readers. Got a problem? Ask Smokey. You'll find the address at the end of the column. Please *print* your name and address.



In the pit: Driver Curtis Turner with Smokey (center) and his son, Little Smokey.

"The disk brakes (on the front) in my '66 Volkswagen squareback squeak. Ten trips to the dealer have done no good."

CHARLES F. SWETZ, Baldwin, N.Y.

Disks are always more or less noisy. I can make two suggestions: Make sure there is no dirt or other road deposit on the disks or linings. For all their virtues, disks can flex and resonate. Write VW's service department in Englewood Cliffs, N.J.

"After seeing the '67 Indy 500, I have some questions. Do you believe Granatelli's turbine car should have been allowed to enter? Or been allowed in any other races? Should turbines be allowed to race only against each other?"

S. R. CHADWELL, Pennington, N.J.

This is the second time these questions have come up. I don't think Parnelli Jones should have been allowed to run in that race. The engine met then-current rules, but the rules were unfair. The rule on power potential has since been adjusted to be more in line with that for piston engines. Of course, if it was eligible at Indy, it should have been allowed to run in other races. I think turbines can hurt racing by sacrificing the interest of piston-engine accessory manufacturers in sponsoring cars—and believe me, they are a big source of the money that makes the mare go. Finally, turbine racing will do little to improve the car you'll drive for at least the next 10 years.

"I have been using 7.75-by-14 Tiger Paws on my '64 Impala with the 283-inch engine, and have had a complete brake job done on it. But the rear wheels spin if I try to accelerate on wet pavement. Also, the rear wheels lock and the car skids during a hard stop. Would adding weight in the trunk help? How about wide tires?"

AL DEMBERT, Seattle, Wash.

Wider tires and the correct pressure will help—but be sure you have the proper rim width for the broader boots. Weight in the trunk will help, but this can be overdone. On brake lockup, the quickest fix is to go to 1/16-inch-smaller rear-wheel brake cylinders.

"My '66 Oldsmobile's power seat won't operate unless the car is warm inside. Replacement of relay and motor hasn't helped."

C. J. RICHTER, Downers Grove, Ill.

Oh, brother! You want a wild guess? It sounds as if some part of the seat motor is wired into the heater circuit. Get a good electrician onto that job!

"My '62 Buick LeSabre, with 40,000 miles on it, and all the power gadgets plus A/C, suffers from high oil consumption. Around town, the oil use is normal; but on the road at 65-75 m.p.h., it uses a quart each 200 miles. The plugs show no evidence of oil when pulled. An air-leakage test showed two cylinders had 35-percent leakage, the others under 20-percent. Several people have suggested a ring job."

LESTER E. CROSBY, W. Palm Beach, Fla.

The power assists have nothing to do with it. Thirty-five-percent leakage is far too much. If this is past the rings into the crankcase, they'll have to be replaced. I suspect the rings are sticking. Be sure the crankcase vent is in good shape (this could

Continued

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Go ahead, shoot

If AC Full Time Firepower doesn't cut down overheating, pre-ignition, or boost power, you might as well do the merciful thing

...Shoot.

AC Fire-Ring Spark Plugs have an exclusive, self-cleaning hot-tip insulator that gets hotter, faster. This hot tip burns away fouling deposits for a more powerful, smoother-running engine. The tip is also recessed to cool faster. This minimizes engine-damaging pre-ignition. If AC Spark Plugs don't help, shoot—you've done the best you could.

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For Safety's Sake, Check your Headlamps—Replace with AC Guide Lamps

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"In 3 hours 'Jeep' 4-wheel drive saved me $36,000."

says David K. Price of Redlands, California.

"When we needed a new pick-up for our citrus farms, we looked carefully at all makes...I kept coming back to the 4-wheel drive 'Jeep' Gladiator and finally decided it might be worth the extra dough. So I bought it. A couple of months later, it became one of the best investments I ever made.

"It had been fairly warm, but by mid-afternoon the temperature started to slide. At 6:00 P.M., I called the weather bureau—'Riverside...32°... Bloomington . . . 30° . . . Redlands . . . 33°...' WOW! Down 10° in an hour! We didn't have one wind machine on.

"I loaded drums of fuel for the wind machines into the Gladiator and took off for our biggest farm—30 miles away. There was a ton of it in the back, but the Gladiator really barreled down the highway.

"When I got there, I still had a hundred yards of deep sand bottom between the road and the machines. I flipped the lever into 4-wheel drive, and stepped on the gas. All 4 wheels started to churn. We sank right to the hub caps in the soft sand, but then the 'Jeep' Gladiator began to grind its way —fuel drums and all—right across the bottom and up to the grove.

"The wind machines were all fueled up and on by 9:15. Not a moment too

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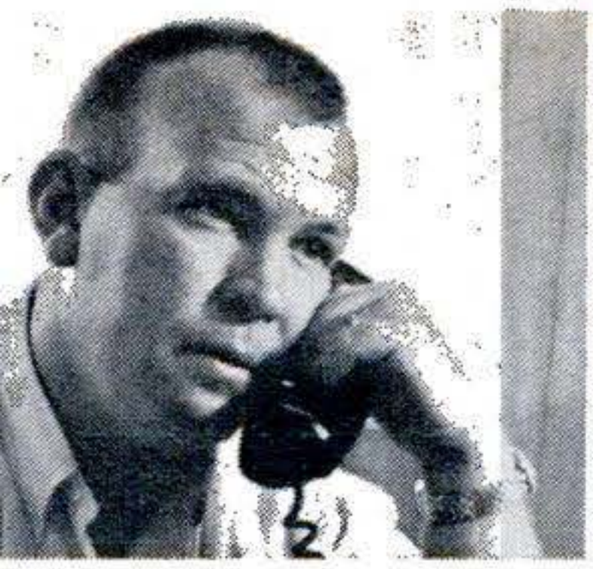

"I called the weather bureau. It was nearly freezing."

"I had to get over a ton of fuel to our wind machines...in a hurry!"

"In between the road and the wind machines was 100 yards of deep sand...uphill!"

An ordinary truck gets stuck automatically when you try to turn in the sand. But even with that load in the back, my 4-wheel drive Gladiator kept churning along."

When the temperature hit freezing, nine wind machines were on. Only one still had to be filled."

"We didn't lose a single orange. And that crop was worth $36,000."

"My whole family enjoys our Gladiator. Especially when we're camping. We love going to places 2-wheel drive trucks could never reach."

soon. At 10:30 it went well below freezing.

"Next day we found we hadn't lost a single orange. That crop was worth $36,000.

"Everyone likes to drive that Gladiator—including my wife. With Turbo Hydra-Matic* automatic transmission, it's a cinch to drive. She also takes advantage of 4-wheel drive...flips it on when the roads turn slippery, for instance (even at 60 m.p.h. it's almost as easy as turning on the lights).

"On days off, we put on the camper and head for the hills. The kids love it, because we push back to places we couldn't go before. I don't worry about getting stuck... not with this baby!

"Sure, we paid a little extra to get this 'Jeep' Gladiator. But I'm so sold on it now—that extra amount would seem cheap if it were twice as much."

*TRADEMARK GENERAL MOTORS CORP.

KAISER Jeep CORPORATION
TOLEDO, OHIO 43601.

'Jeep' Gladiator

You've got to drive it to believe it.
See your 'Jeep' dealer. Check the Yellow Pages

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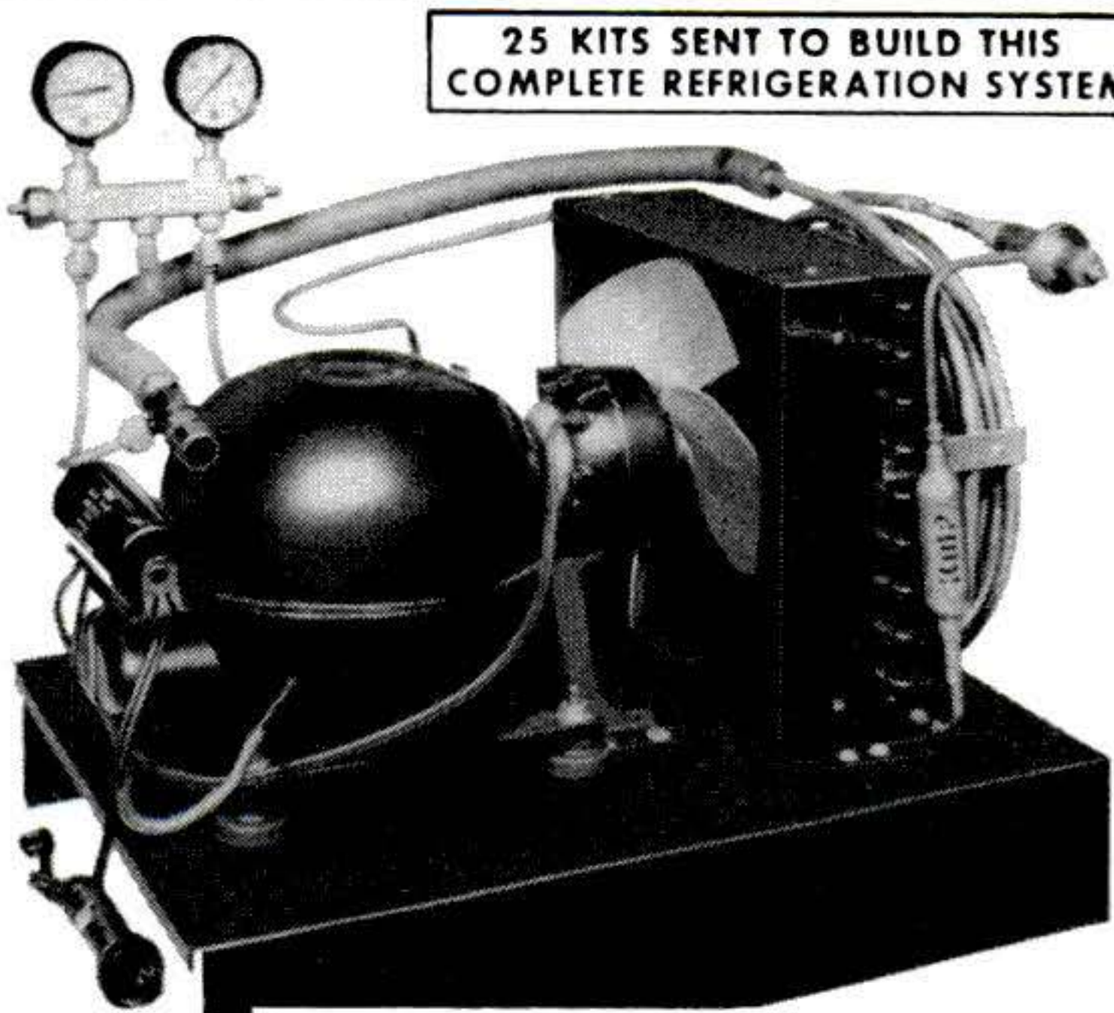

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be the seat of your problem), the valve guides are within tolerances, and the cam timing has not become late from wear.

"Four months after a major tune-up, I had to take our '65 Ford Fairlane with 289-inch engine back to the mechanic because it had developed a miss. A plug was fouled out. The man told me off-brand gasoline caused the trouble. I thought all 'regular' gasolines were the same, regardless of brand."

J. L. NELSON, Omaha.

If the plug was burned out—not fouled out—it could be bad fuel, or the carburetor is too lean, or the timing too advanced. All "regular" gasolines are not alike. You can check on whether it's the fuel or the mechanic merely by switching brands of gas. But this sounds to me more like ring or valve-guide trouble in that particular hole. That would produce oil fouling.

"What causes the valves in my '64 Rambler six to burn out so fast? The engine was rough at the 1,000-mile check, so the valves were adjusted. They were adjusted again at 6,183. At 15,641, a new head gasket was installed. At 23,513, the valve seats were ground and the valves replaced. At 35,604, two valves were burned, the seats ground again, and the valves replaced. In another 2,000 miles, two more valves were burned. Being a woman, I am at a disadvantage in dealing with the mechanic."

LOIS GRANT, Pine Grove, Calif.

I am impressed by the careful records you keep. Trouble like yours should not happen to a motorist of either sex. Get premium replacement valves. Have the exhaust and cooling system checked thoroughly, and repaired if necessary. Have Rambler specify fuel. Workmanship *might* be an issue, but even an expert mechanic can't cope with engine-aging problems. Heat is the only reason valves burn. As a car gets older, an engine's heat-rejection capabilities start to fade.

"The heater in a 1963 Ford Galaxie I bought recently didn't function right. The temperature gauge was normal, but I replaced the thermostat with one of 180 degrees, with no improvement. I drained and flushed the system with heavy-duty cleaner, with no results. Then I disconnected the heater hoses and flushed the heater with hot water and blew it out with compressed air. It worked all right for a week,

Continued

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How Renault got up off the floor.

Things were none too cheery for us a while ago. We were, as they say, getting our lumps.

But those days, happily, are far behind us. We've made a comeback.

Sales are up 85% over last year. And proceeding quite nicely, thank you.

How did Renault accomplish this dramatic turnabout?

By the most time-honored means you can imagine: Hard work. Sweat. And a touch of anger.

We dropped a few dealers who were blasé about service.

We made sure every dealer we kept could get virtually any part in 48 hours. If not faster.

But most important, we built the Renault 10.

It has thicker gauge metal, thicker undercoating, and a few engineering touches that border on the fanatical.

It delivers an honest 35 miles to the gallon.

30,000 miles between brake pad replacements.

18,000 miles or two years before you even have to consider replacing water or anti-freeze.

40,000 miles on our Michelin X tires. ($5 more per tire, but well worth it.)

And you can pile up those miles in spectacularly comfortable seats. You couldn't get better seats if you spent $5,000.

Yet, the Renault 10 is priced under $2,000. Way under $2,000.

All in all, the car is a bit better than it has to be for the money.

But then, we figure the best way for us to get back on our feet is to offer you a value that will really floor you.

RENAULT

The Renault 10

AUTOMATIC TRANSMISSION AND AIR-CONDITIONING OPTIONAL.
FOR NEAREST DEALER OR INFORMATION ON OVERSEAS DELIVERY, WRITE RENAULT, INC., BOX 11,750 THIRD AVE., NYC 10017

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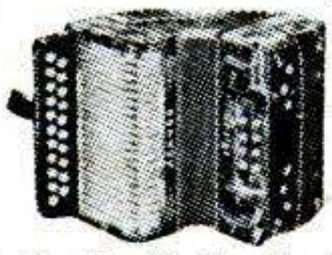

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☐ I have a trade-in

"Say, Smokey—"

[*Continued*]

then had a relapse. What now—short of removing the heater?"

JERRY THOMPKINS, St. Louis, Mo.

You didn't go far enough. Have the heater core cleaned out at a professional radiator shop. Have the hoses checked carefully for obstruction. Look into the chance of air lock. The radiator may still be dirty and plugged up despite what you've done. Only in mild cases will a chemical take care of a plugged radiator or heater core.

"The owner's manual for my new '67 Chrysler recommends multiviscosity engine oil. I have always used one-weight oil in my cars—20 in winter, 30 in summer. Why should I change? Just what does multiviscosity do that a good single weight can't?"

ORVIN E. NEUMEIER, Norfolk, Neb.

Don't try to out-engineer the engineers who built your car. Multiviscosity oil is a type that is thin when it's cold, but thickens when the heat's on. I recommend that you read "Oil for Your Car" [PS, Sept.].

"Could I build a Volkswagen 'fun bug' from my '57 VW? Would it make it through the snow here? What would be the best tires for performance, considering VW horsepower?"

DONALD DOERR, Battle Creek, Mich.

You can make a good snow buggy out of your VW. The wider the tires you can fit, the better. Maybe you'd be better off to purchase a conversion kit. Write Bill Cheeseburg, c/o Champion Spark Plug Co., Toledo. His kit is reasonable in price.

"My '65 Volvo with 50,000 miles on it loses its valve clearances. While driving at about 65, I lose power and the engine heats up. Checking the engine when cool, I find no clearances on cylinders three and four, and about 5/1,000 on one and two. I've reset valves and had the dealer check; no results. The locking nuts are always tight, the engine perfectly timed and tuned."

FRANK ANRICH, Winnipeg, Can.

You'd better do a complete valve job fast. I believe your valves are "tuliping" into the seats, or stretching in the stems. I hope that by now one hasn't broken.

Got a question on autos? Send it to:
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355 Lexington Ave., New York, N.Y. 10017.
Not every question may be used. Questions cannot be answered by individual letters.

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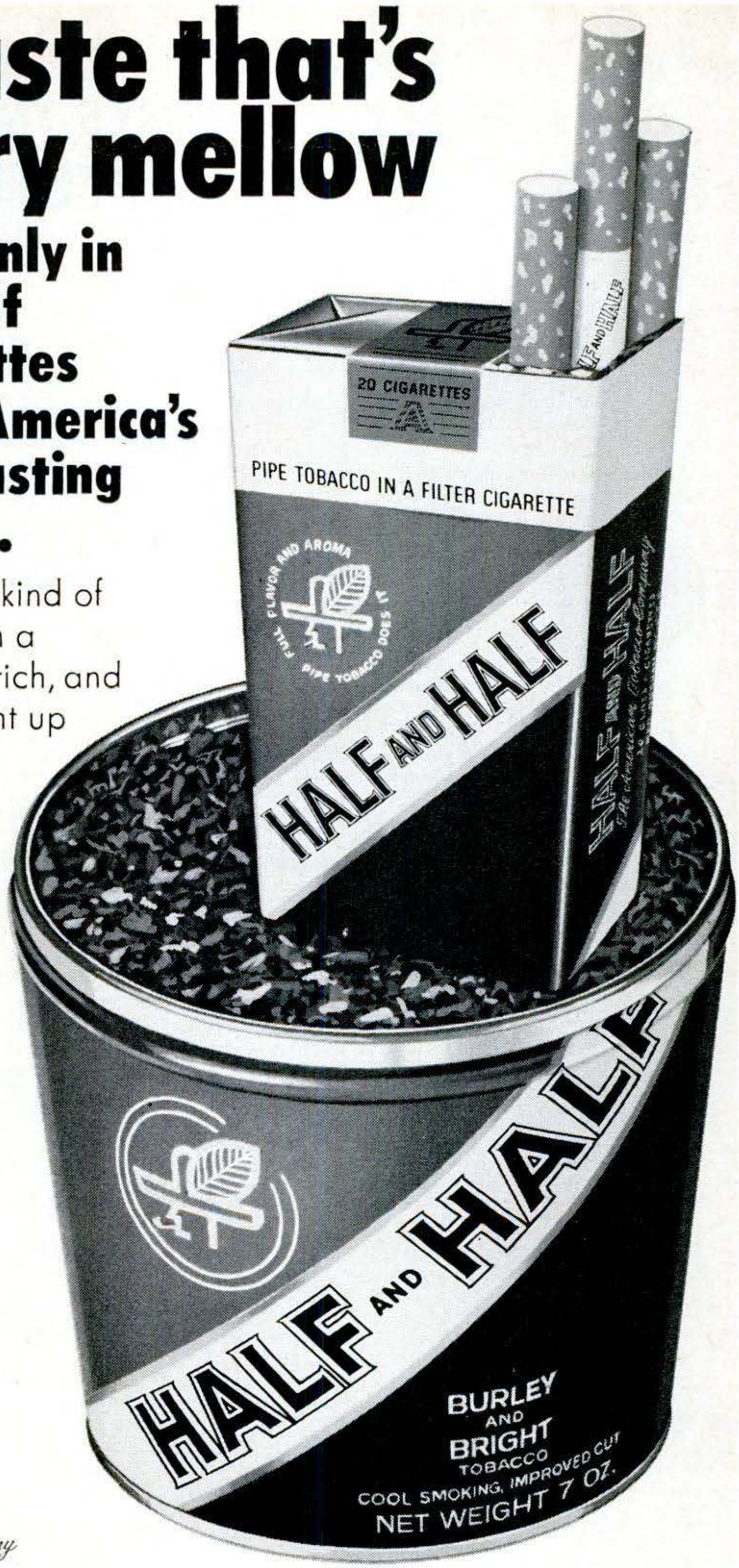
The taste that's country mellow

You find it only in Half and Half Filter Cigarettes made from America's mellowest tasting pipe tobacco.

Get yourself a new kind of flavor and aroma in a filter cigarette: full, rich, and country mellow. Light up a Half and Half.



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YOU CAN WIN

That's right . . . if you had been a member of our **Puzzle Lovers Club,** you could have won thousands of dollars. This year, our Club is offering a minimum of $100,000.00 in cash awards to Club members just for solving puzzles in their leisure time . . . IN THEIR OWN HOMES.

Each month, people like yourself, who love to solve puzzles, but never before won any money, share in the fun and excitement of our contests and walk away with cash prizes that add up to many thousands of dollars . . . AND SO CAN YOU!

Our **Puzzle Lovers Club** winners are people just like yourself . . . men and women who never believed that they could have the kind of money paid to sports, TV and movie stars. Our gifted winners have used their cash prizes to do the things they've always dreamed about . . . pay off the mortgage, take a long vacation, start a farm, buy a new wardrobe, install air conditioning.

Here are just a few of thousands of winners: Over $1,000.00 in cash to a Maryland fan; $2,500.00 cash award to a Colorado gentleman; $1,250.00 cash to a San Diego contestant; more than $2,500.00 to a Pennsylvania Puzzle Lover.

How would you feel if you won $5,000.00? "It's a thrill that comes just once in a lifetime," said Mrs. Carl Mouness of La Crescenta, Calif., as she received her cash prize. Men and women of all ages have won tremendous cash awards from our **Puzzle Lovers Club.**

Frances Nation, Puzzle Lovers Club winner from Oklahoma City, was overjoyed as she received her $305.88 award.

HERE'S YOUR CHANCE TO TRY OUR CONTESTS AND SEE HOW MUCH YOU CAN WIN EACH MONTH

How do they do it? They are members of the world's only puzzle club that holds regularly scheduled competitions and offers cash prizes to winners. Membership in our Club offers you the fun and excitement of puzzle solving, educational information on how to use language and words, the opportunity of winning thousands of dollars each month PLUS extra bonus puzzles each year with prizes ranging all the way up to $100,000.00. Our **Puzzle Lovers Club** limits competition and awards to members only. Our membership is kept small, so that your pleasure, excitement and cash prizes are B-I-G!

Edna B. Dupler, Millersport, Ohio, walked away with $500.00 in Puzzle Lovers Club contest cash. "My friends said I was wasting my time."

ABSOLUTELY FREE

Don't send a penny . . . see if you have the talent to win . . . right in the privacy of your own home. Your "ticket" to fortune offers you a FREE sample copy of our **Puzzle Lovers Newspaper** . . . AT NO COST TO YOU! As a member of our Club, you can look forward to fun, excitement, thrills and education. You'll enjoy fascinating hours of friendly competition with men and women like yourself.

AND YOU'LL HAVE DOZENS OF OPPORTUNITIES TO WIN EXTRA CASH IN YOUR SPARE TIME!

There is no obligation to enter our contests. If you decide to compete for our money, there's nothing to buy, no jingles to write, no boxtops to send. WHEN YOU WIN, THE MONEY IS IN YOUR HANDS WITHIN ONE WEEK. No other contest group in the world pays you faster than our **Puzzle Lovers Club.** Discover how you, too, may cash in by doing our puzzles in your leisure time.

"Thank you for that beautiful $1,400.00 check," was the way Sue Repetto, Fort Worth, Tex., reacted to news of her victory.

CLIP YOUR "TICKET" TO EXTRA MONEY RIGHT NOW! YOU MAY RECEIVE YOUR FIRST BIG CASH PRIZE IN JUST A FEW WEEKS

"I felt that I had a winner," wrote Robert Dallons, Aurora, Colo. He's a contestant who was awarded a $2,500.00 cash prize.

WIN CASH

AFFIX THIS COUPON TO POSTCARD FOR FAST HANDLING OR MAIL IN ENVELOPE

Gentlemen: **PUZZLE LOVERS CLUB** Box 2, Prince Street Station New York City, N. Y. 10012

Please send my FREE copy of your newspaper plus all details on your CASH PRIZE CONTESTS. I am under no obligation to pay anything. If I join the Club, I may compete for all prizes and spend the cash I win anyway I want.

Please print and include Zip Code

Name _____

Address _____

City _____ *State* _____ *Zip* _____

☐ If you are under 18, check here for complimentary prize Booklet A.

18-4

WIN EXTRA CASH IN YOUR OWN HOME IN YOUR SPARE TIME

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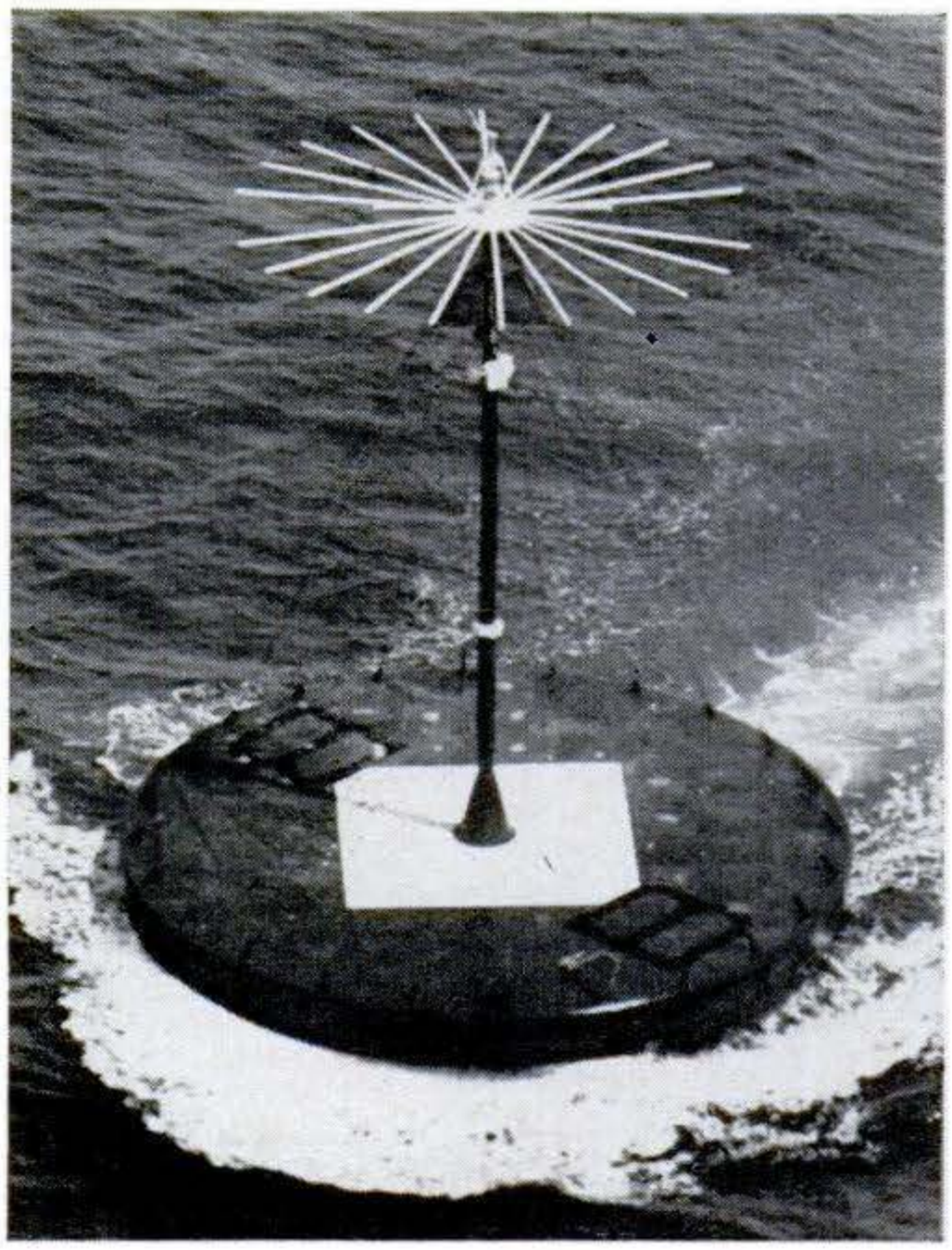
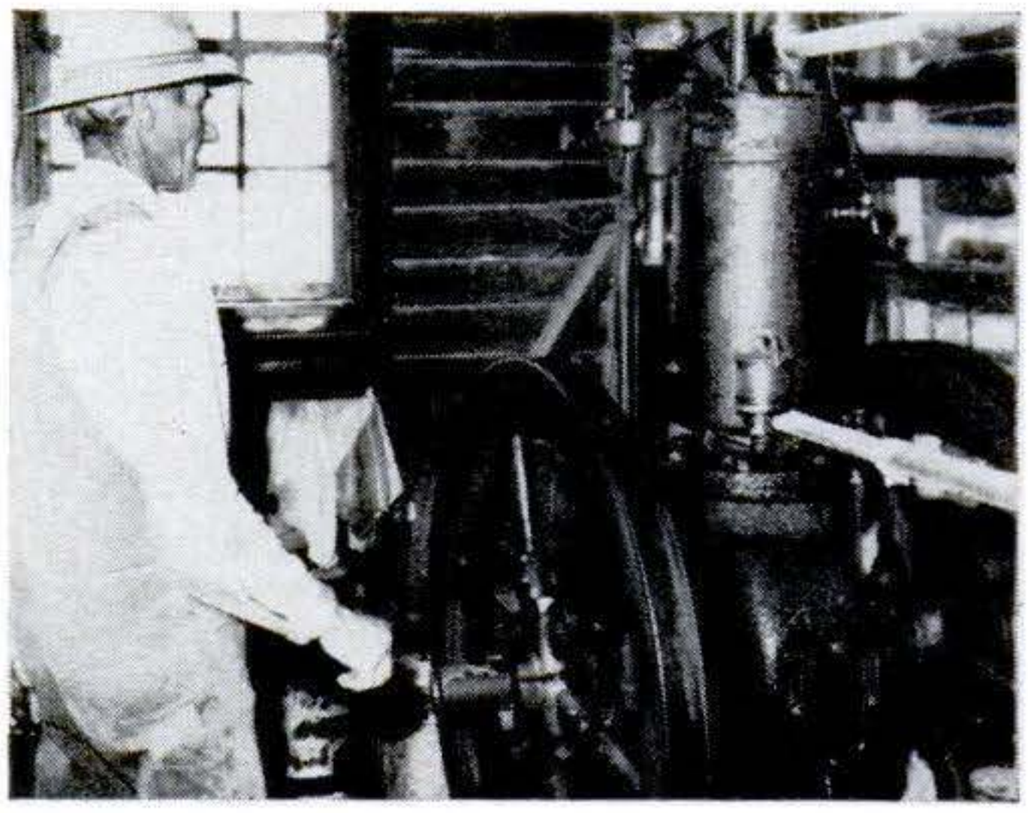


Meet a monster

Ocean vessels approaching New York harbor come upon this king-size pie plate topped by a most peculiar umbrella. It's a 50-ton buoy, 40 feet across. Its crown of antennas and navigational aids respond to shore commands and questions even in seas buffeted by hurricane-force wind. Its light is visible 10 miles.



Sixty years of chug-chug-chug

When Otto Brueggemann, shown here, was four years old his father bought this nine-hp. upright gasoline engine to power feed-cutting machinery on a farm near Venedy, Ill. It's still working, after 60 years, and has been overhauled just once. A Fairbanks-Morse, it cost $300 new.

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On sale at Sears !
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A big 7-inch saw with professional features like a safety clutch to prevent kickback. Regularly $41.99. Now $28.88.

Save $13.11! You can crosscut, rip cut, bevel cut—build anything from a fence to a boat with the versatile Craftsman® circular saw.

It has a full wraparound base for better stability. The side-ejection sawdust chute directs dust away from the cutting line. The clear-view housing lets you see *exactly where* you're cutting.

The cutting angle and depth of cut are easily adjustable, too. (You can adjust the blade angle from 0° to 45° and it will bevel cut 2 x 4's. At a 90° cut, depth is adjustable to 2 5/16 in.)

The powerful motor develops 1¾ HP and if the saw should hit an obstruction, the safety clutch stops the blade *automatically*.

There are even rugged ball bearings at heavy-wear points. Sale ends November 25, 1967. No Money Down on Sears Easy Payment Plan. **You can't do better than Sears.**

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Science Newsfront

Last-minute news and notes to keep you up-to-date

By W. STEVENSON BACON

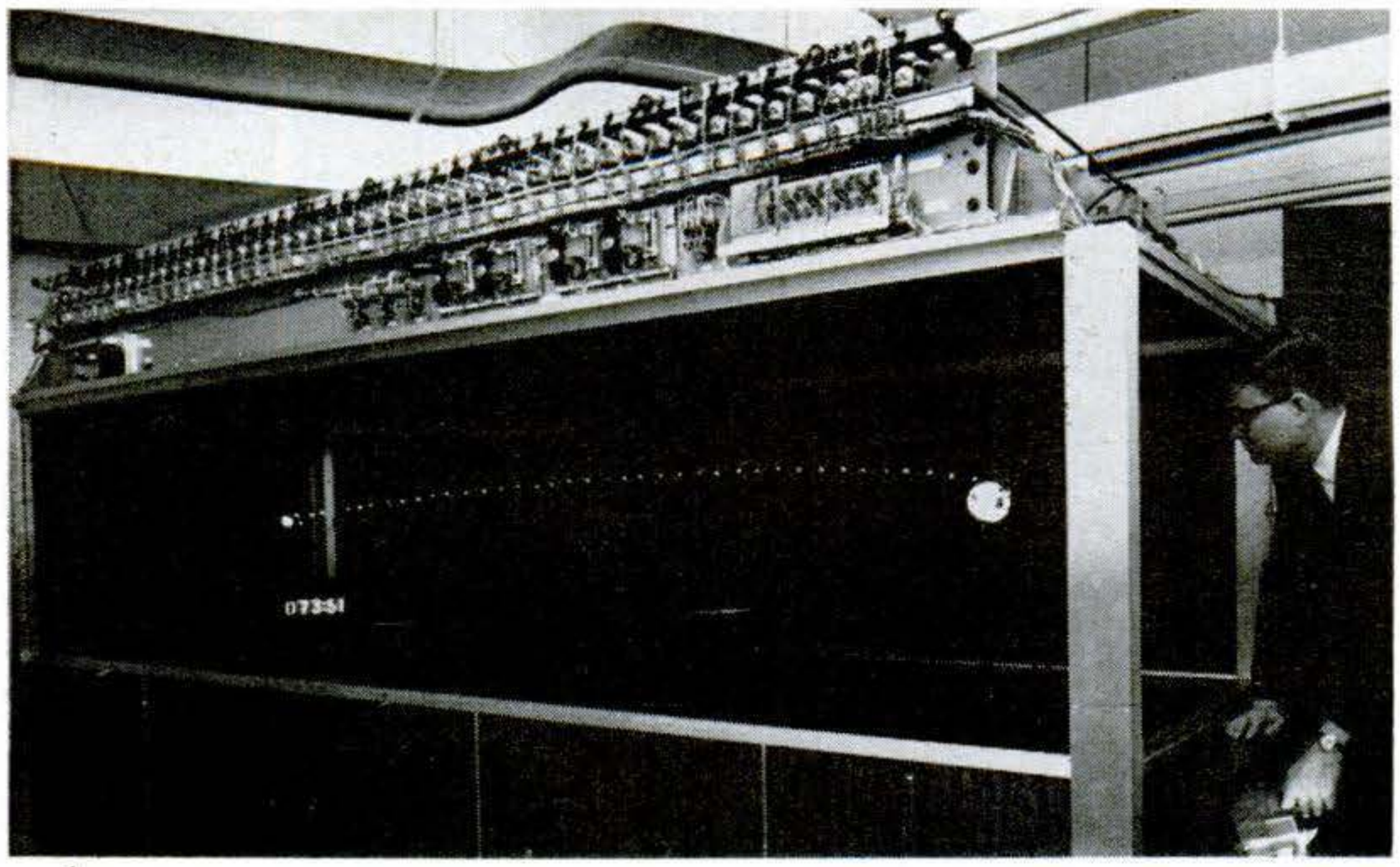
Steam-powered autos are shaping up as the big challenger to the smoky internal-combustion engine. This month, Ford Motor Co. will take delivery on a steam-powered Ford modified by Williams Engine Co., Ambler, Pa. Williams is also selling steam-driven Chevelles with a 150-hp., four-cylinder engine ($10,250). Advantage of steam: Fuel remains longer in the combustion chamber and is almost completely burned. This results in an enormous drop in pollutants from the exhaust. Some engineers feel that steam may be the only practical alternative to internal-combustion engines, and that steam-car prices would be competitive with those of today's cars since steamers could be designed without a transmission.

Adding more zap to the astronauts' "zot gun" is a serious problem for space engineers. The hand-held zot gun is used for maneuvering during space walks, and the compressed-gas versions used to date work only for a short period before running out of gas. Now, Rocket Research Corp. has developed a burning-jet version fueled with hydrazine and water. It uses three miniature rocket motors for directional control, two with one pound and one with two pounds of thrust. The gun gives six times more maneuvering time and can be refueled in space. Fuel mix was selected to keep "zap" down to about 500 degrees F., a temperature that won't damage space-suits.

You may be on color TV if you ever have a surgical operation. A miniature camera that can pick up images from inside the body with no more light than that given off by a penlight bulb is being used for the first time to guide surgeons in their work. The light can be transmitted to the site of the operation—and the image from the site—using flexible, fiber-optic tubes. The camera itself, developed by CBS Laboratories, weighs less than 10 pounds and works at starlight illumination levels.

A fuse that patches itself when it blows out has been invented for places where you just can't change a fuse—orbiting satellites, for example. The gadget, which may also have some uses in cars and home appliances as a thermostat, is simple and ingenious. It's made of silver-plated copper particles in an epoxy resin. When an electrical overload heats it up, the epoxy expands and pushes the metal particles apart, cutting off the current. Resistance is about 0.1 ohm at normal temperature to more than a million ohms in a short circuit. Invented by Edward F. Thomas of NASA, the

Continued



Keeping an eye on the progress of space probes traveling between earth and moon is this lunar trajectory display device. It traces out spacecraft paths with miniature lamps. Constructed by IIT Research Institute for NASA, the display lowers 102 miniature lamps and moves them horizontally and vertically on 102 carriages, each driven by digital stepping motors. The system shows current position, path traversed, and future course.

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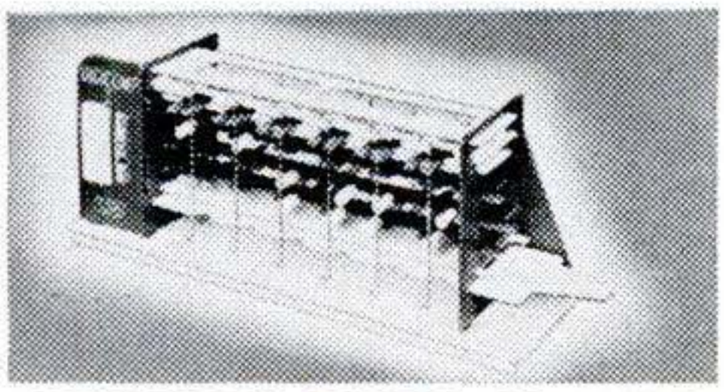

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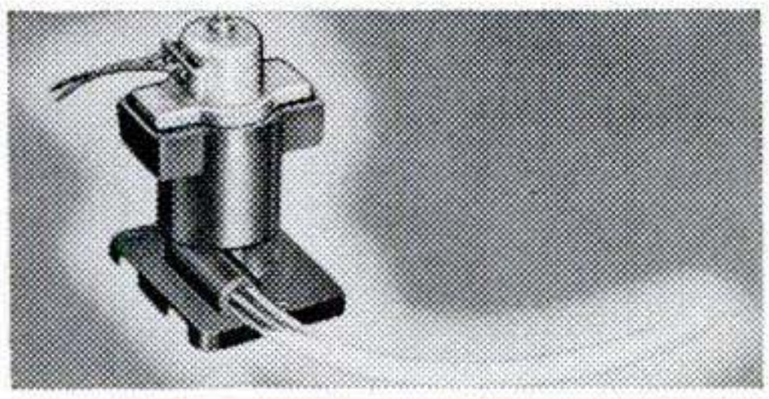

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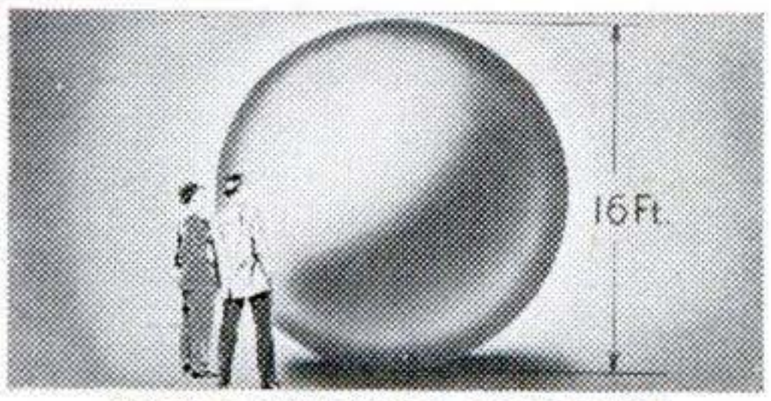

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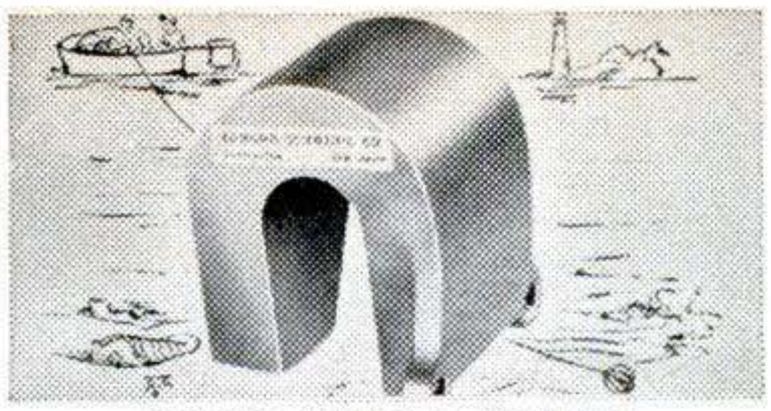

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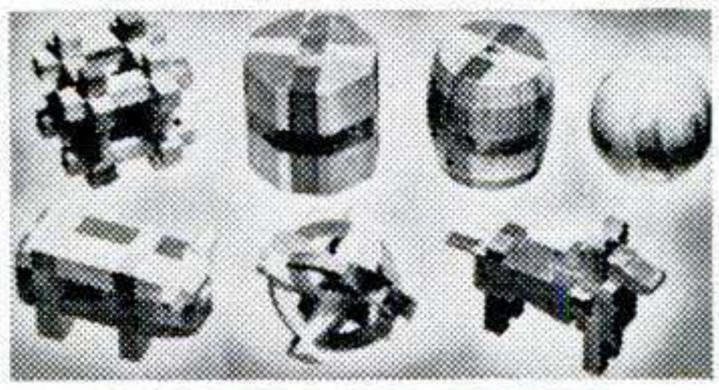

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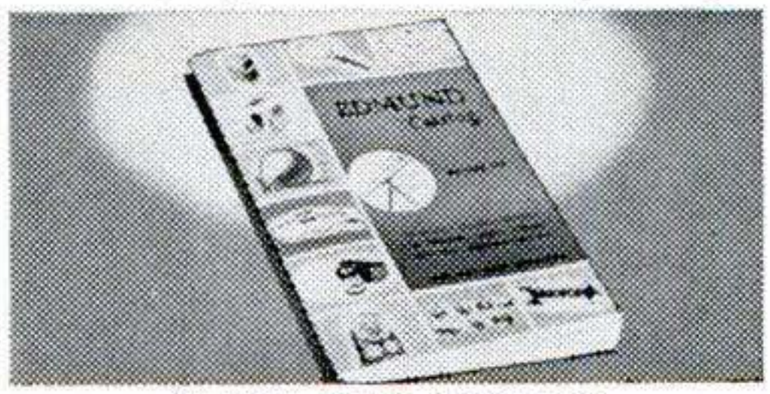

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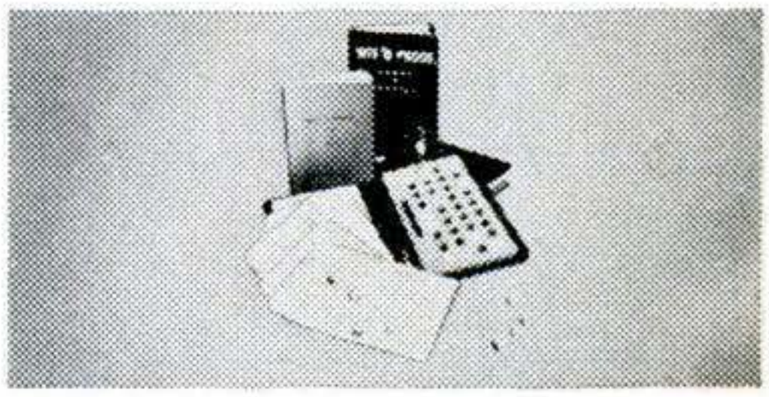

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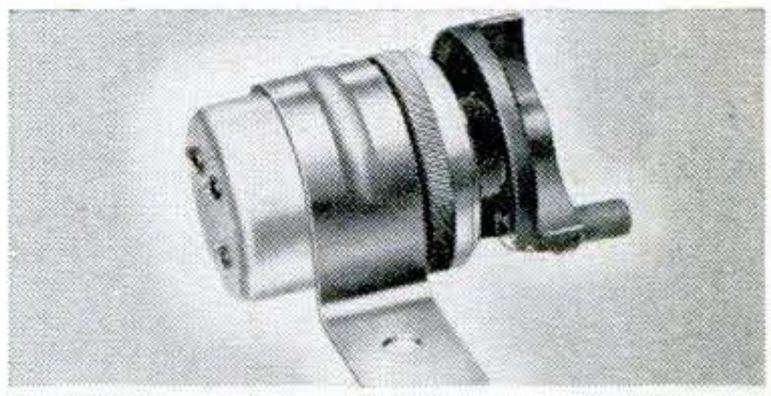

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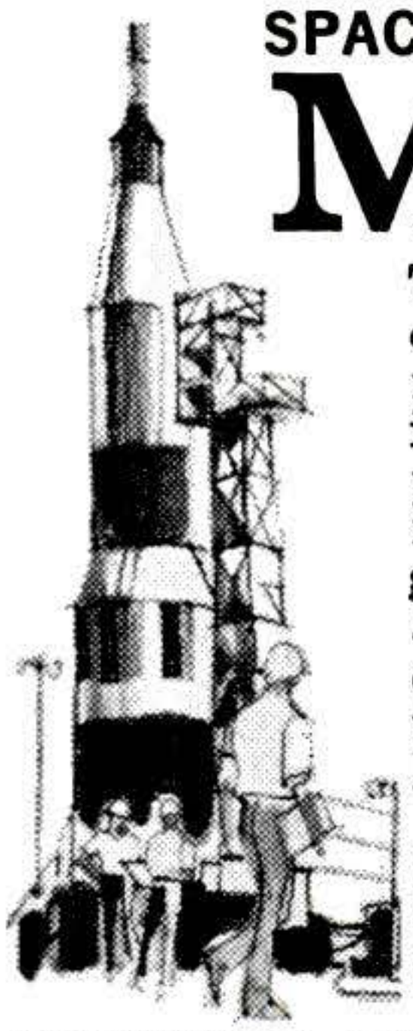

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fuse can be molded into any shape or size; the material can even be made into fusible conducting wires.

A unique rotating cylinder built into an airplane wing can increase lift at takeoff by almost 50 percent. Weird as it sounds, the device may play a big part in future aircraft design since it should cut down the

length of runway needed to get planes like the big jumbo jets off the ground. As shown in the drawing, the cylinder increases lift greatly without adding significantly to aerodynamic resistance—this because it rotates rapidly in the direction of air-flow. Developed by NASA at the Ames Research Center, it will first be tested by the U.S. Navy on an OV-10 aircraft.

Wheel-less air-cushion transit trains doing 200 m.p.h. and faster will be powered by a huge 2,500-hp. electric motor now being built by AiResearch Manufacturing for the U.S. Department of Transportation. Linear motors are much like ordinary AC induction motors except that the field coils are laid out flat in a straight line. A specially constructed guideway acts as the motor's armature. There is nothing to wear out since the motor has no moving parts, and, because the train will ride on an almost frictionless air cushion, high speeds will be easy to attain. The U.S. project is similar to a train being developed by British Railways. Both will test for the first time the aerodynamics of vehicles and motors. [See "Make Way for Aircraft Speeds on the Ground," Oct. For other rail travel news, see page 106 of this issue.]

A new spray-on "memory" chemical gives clothes a permanent press that lasts indefinitely. With durable press pants and other clothes, chemical bonds give the fabric its memory by linking together large numbers of linear molecules—much like zipping together the two sides of a zipper. A new spray-can preparation, "Alter-Ease" made by J. P. Stevens & Co., Inc., acts as a catalyst to destroy chemical bonds in durable

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press garments. It then re-establishes them with different pairs of molecules when they are pressed. The spray can be used to alter durable press garments or put a new press into worn clothing.

The dream house of the future will clean itself, purify the air, and control the humidity. In a study project sponsored by Armco Steel Corp., students designed floors that simply "ingest" dirt when cells in the floor are activated by pressure from walking. Ceilings are fitted with devices that emit water vapor—and also put out fires. Lastly, wall panels packed with algae purify the air as it's pumped through them.

You'll look tanned and healthy all year if you light your home with new fluorescent tubes now being designed to give off visible and ultraviolet light like sunlight. The new lights are the result of special gas mixtures and testing procedures developed by Duro-Test Corp. According to the company, it will soon be possible to produce lamps that will give you a suntan, perhaps while you read a newspaper, or that will meet special health needs prescribed by a doctor. The Vita-Lite, first of the new lamps, is now being sold for general lighting. Although it exactly matches the spectrum of sunlight, its output is below the suntanning level.

Ever watch the locomotive wheels slip on the rails as a train pulls out of the station? The problem was bad enough with the heavy, old-time steam locomotives, but railroad men claim it is even worse since they've been replaced by the lighter diesel-electrics. The answer, says an English firm, Tetronics Research and Development Co., Ltd., is two low-voltage, high-current plasma guns mounted on the locomotive. From the guns shoot blasts of ultraviolet radiation and ozone that break down the friction-reducing oil film that makes wheels slip.

Do-it-yourself shock therapy may be the best way to cure yourself of bad habits such as cigarette smoking, nail biting, or overeating. In an experiment conducted by psychologist Bradley Bucher of the University of California, volunteers feeling the need to reform carried small battery-powered "shockers" in their pockets. To use the device—when you feel like smoking, for example—you squeeze two electrodes simultaneously, giving yourself a mild-to-moderate electric shock. The shocker has been very successful with nail biters and about 50 percent successful with cigarette smokers. PS

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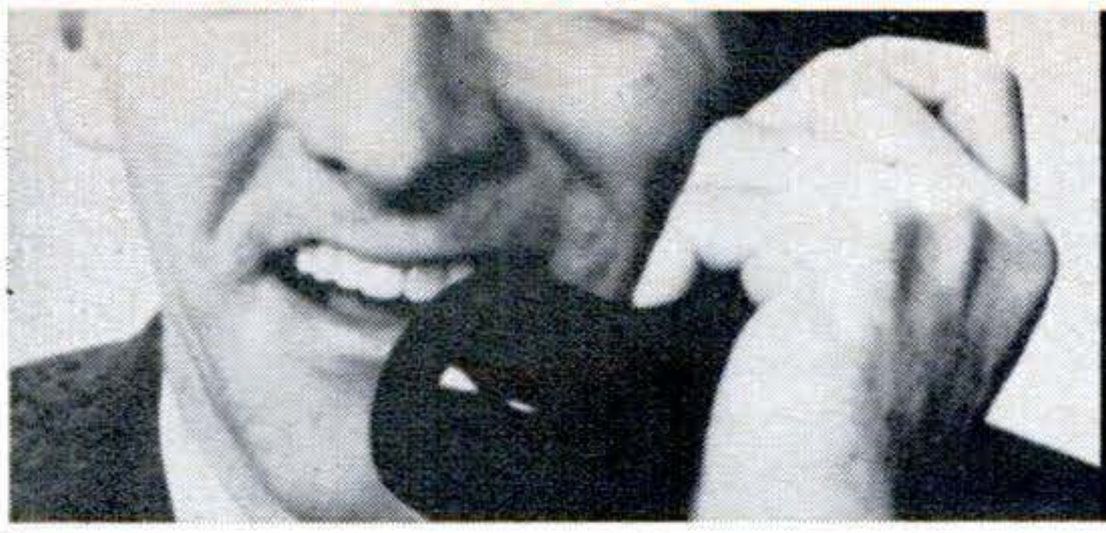

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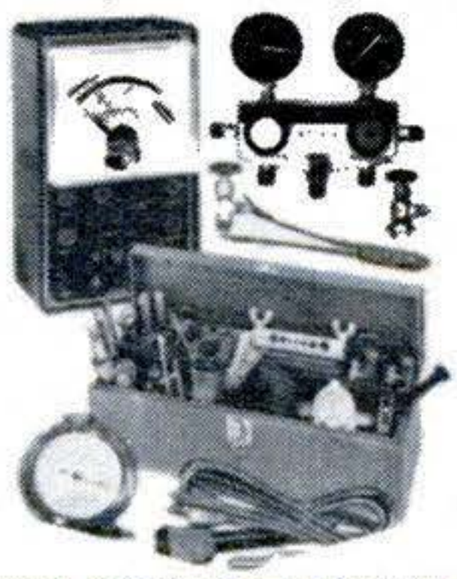

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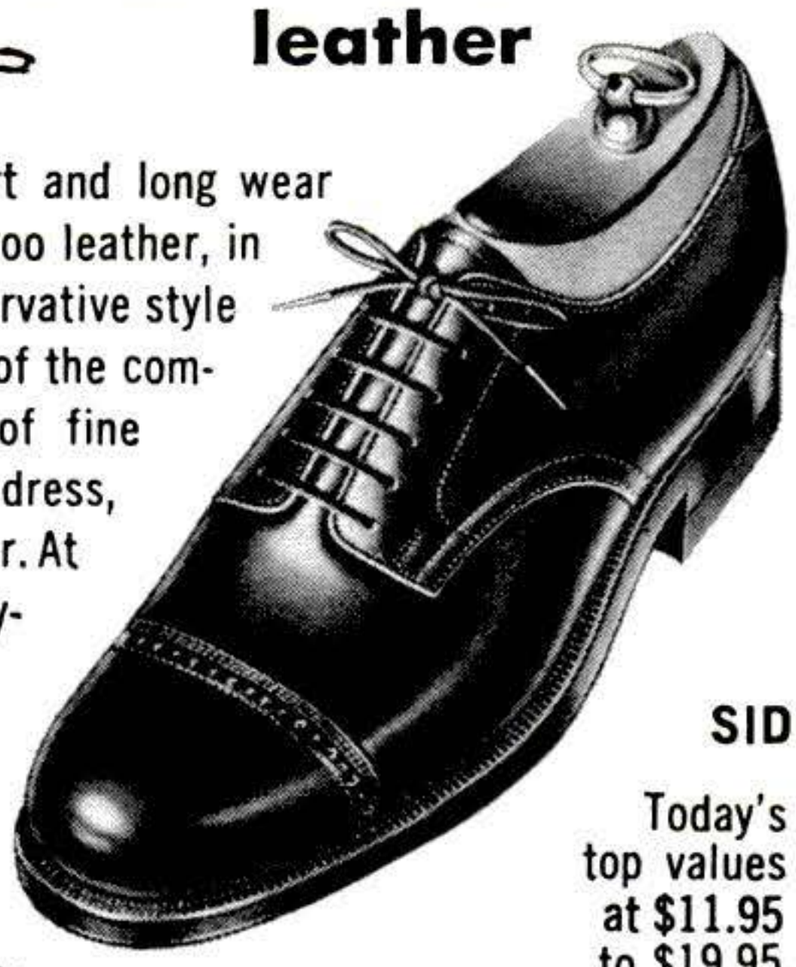

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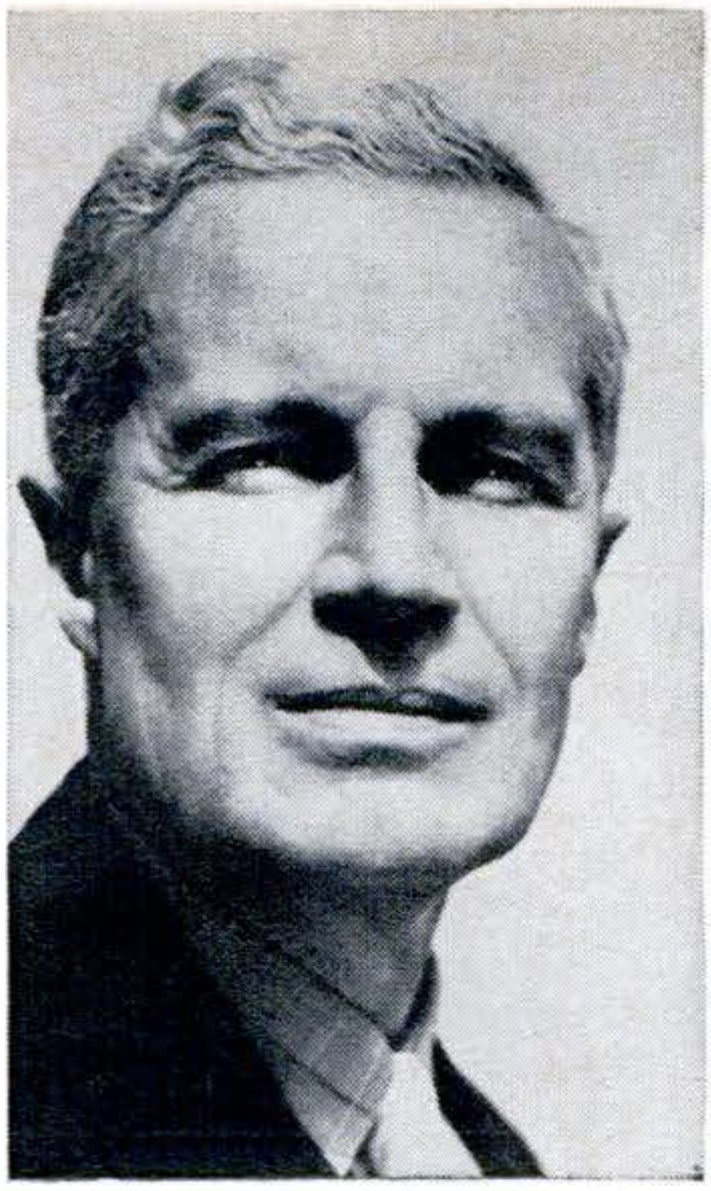

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I was young once, as you may be — today I am older. Not too old to enjoy the fruits of my work, but older in the sense of being wiser. And once I was poor, desperately poor. Today almost any man can stretch his income to make ends meet. Today, there are few who hunger for bread and shelter. But in my youth I knew the pinch of poverty; the emptiness of hunger; the cold stare of the creditor who would not take excuses for money. Today, all that is past. And behind my city house, my summer home, my Cadillacs, my winter-long vacations and my sense of independence—behind all the wealth of cash and deep inner satisfaction that I enjoy—there is one simple secret. It is this secret that I would like to impart to you. If you are satisfied with a humdrum life of service to another master, turn this page now—read no more. If you are interested in a fuller life, free from bosses, free from worries, free from fears, read further. This message may be meant for you.

By Victor B. Mason

I am printing my message in a magazine. It may come to the attention of thousands of eyes. But of all those thousands, only a few will have the vision to understand. Many may read; but of a thousand only you may have the intuition, the sensitivity, to understand that what I am writing may be intended for you—may be the tide that shapes your destiny, which, taken at the crest, carries you to levels of independence beyond the dreams of avarice.

Don't misunderstand me. There is no mysticism in this. I am not speaking of occult things, of innumerable laws of nature that will sweep you to success without effort on your part. That sort of talk is *rubbish!* And anyone who tries to tell you that you can *think* your way to riches without effort is a false friend. I am too much of a realist for that. And I hope you are.

I hope you are the kind of man—if you have read this far—who knows that anything worthwhile has to be *earned!* I hope you have learned that there is no reward without effort. If you have learned this, then you may be ready to take the next step in the development of your karma—you may be ready to learn and use the secret I have to impart.

I Have All The Money I Need

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Please don't misunderstand this statement. I am not a philanthropist. I believe that charity is something that no proud man will accept. I have never seen a man who was worth his salt who would accept something for nothing. I have never met a highly successful man whom the world respected who did not sacrifice something to gain his position. And, unless you are willing to make at least half the effort, I'm not interested in giving you a "leg up" to the achievement of your goal. Frankly, I'm going to charge you something for the secret I give you. Not a lot—but enough to make me believe that you are a little above the fellows who merely "wish" for success and are not willing to sacrifice something to get it.

A Fascinating and Peculiar Business

I have a business that is peculiar—one of my businesses. The unusual thing about it is that it is needed in every little community throughout this country. But it is a business that will never be invaded by the "big fellows." It has to be handled on a local basis. No giant octopus can ever gobble up the whole thing. No big combine is ever going to destroy it. It is essentially a "one man" business that can be operated without outside help. It is a business that is good summer and winter. It is a business that is growing each year. And, it is a business that can be started on an investment so small that it is within the reach of anyone who has a television set. But it has nothing to do with television.

This business has another peculiarity. It can be started at home in spare time. No risk to present job. No risk to present income. And no need to let anyone else know you are "on your own." It can be run as a spare time business for extra money. Or, as it grows to the point where it is paying more than your present salary, it can be expanded into a full time business—overnight. It can give you a sense of personal independence that will free you forever from the fear of lay-off, loss of job, depressions, or economic reverses.

Are You Mechanically Inclined?

While the operation of this business is partly automatic, it won't run itself. If you are to use it as a stepping stone to independence, you must be able to work with your hands, use such tools as hammer and screw driver, and enjoy getting into a pair of blue jeans and rolling up your sleeves. But two hours a day of manual work will keep your "factory" running 24 hours turning out a product that has a steady and ready sale in every community. A half dollar spent for raw materials can bring you six dollars in cash—six times a day.

In this message I'm not going to try to tell you the entire story. There is not enough space on this page. And, I am not going to ask you to spend a penny now to learn the secret. I'll send you all the information, free. If you are interested in becoming independent, in becoming your own boss, in knowing the sweet fruits of success as I know them, send me your name. That's all. Just your name. I won't ask you for a penny. I'll send you all the information about one of the most fascinating businesses you can imagine. With these facts, you will make your own investigation. You will check up on conditions in your neighborhood. You will weigh and analyze the whole proposition. Then, and then only, if you decide to take the next step, I'll allow you to invest $15.00. And even then, if you decide that your fifteen dollars has been badly invested I'll return it to you. Don't hesitate to send your name. I have no salesmen. I will merely write you a long letter and send you complete facts about the business I have found to be so successful. After that, you make the decisions.

Does Happiness Hang on Your Decision?

Don't put this off. It may be a coincidence that you are reading these words right now. Or, it may be a matter that is more deeply connected with your destiny than either of us can say. There is only one thing certain: If you have read this far you are interested in the kind of independence I enjoy. And if that is true, then you must take the next step. No coupon on this advertisement. If you don't think enough of your future happiness and prosperity to write your name on a postcard and mail it to me, forget the whole thing. But if you think there is a destiny that shapes men's lives, send your name now. What I send you may convince you of the truth of this proverb. And what I send you will not cost a penny, now or at any other time.

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JOE E. WAREN *says,* "Paid entire tuition and made $800 besides in sparetime, even before completing training." ***Overland Park, Kan.***

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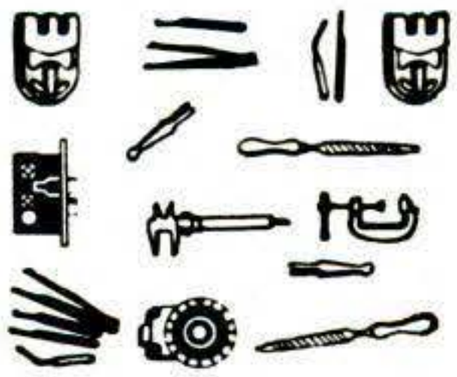

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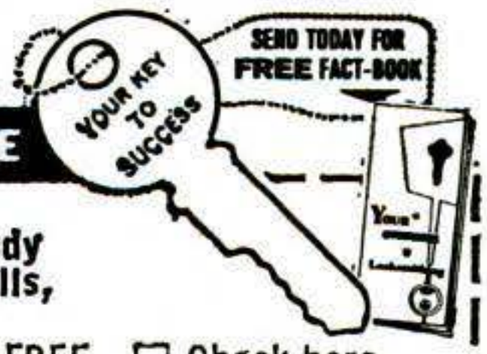

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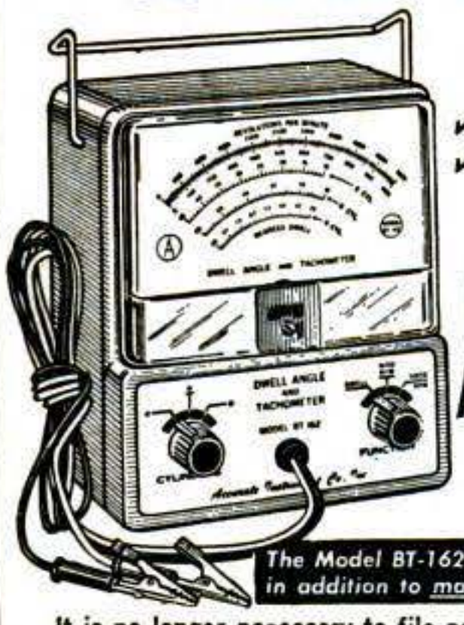

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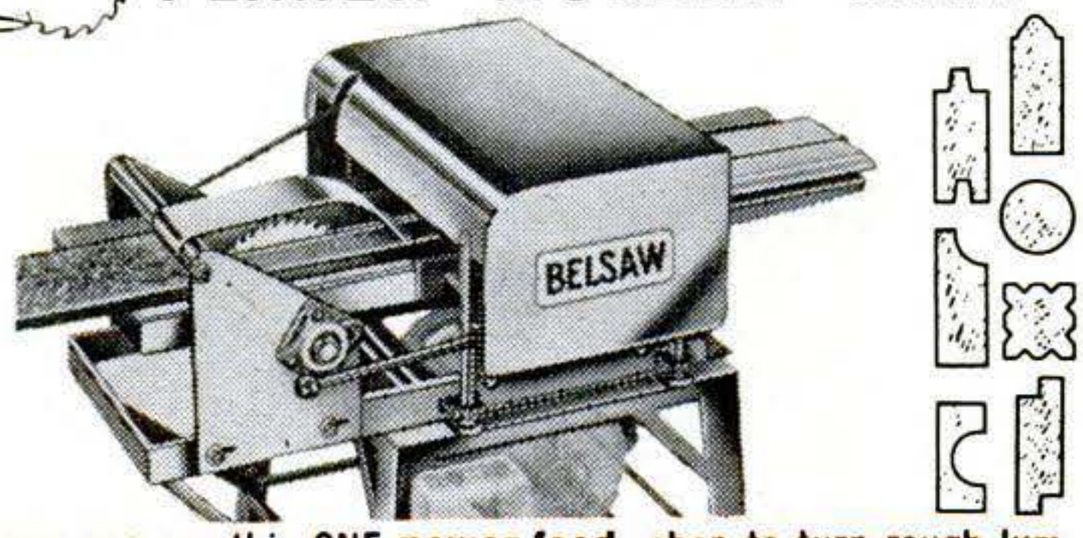

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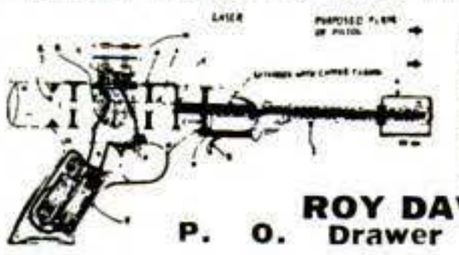

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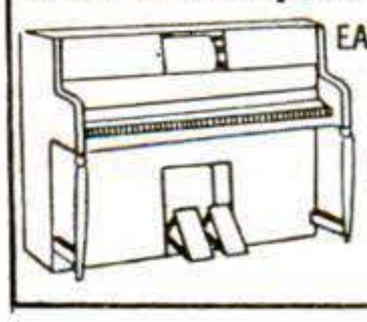

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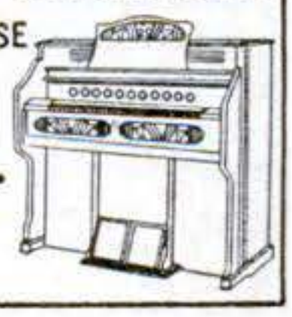

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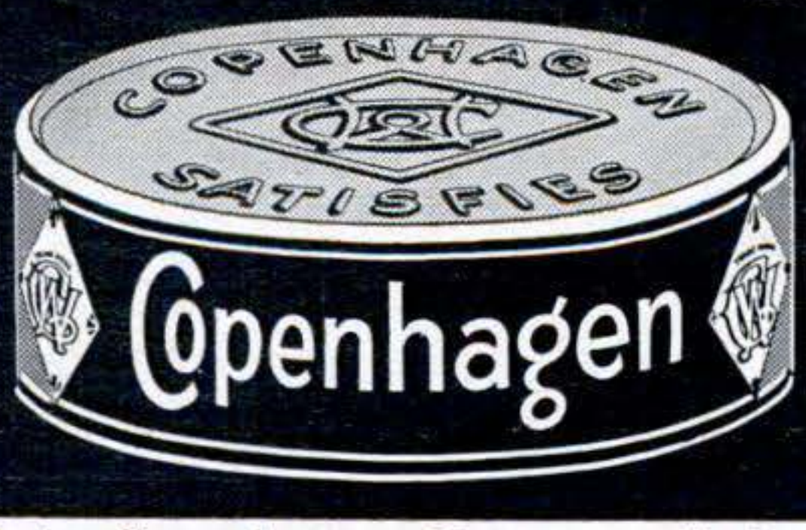

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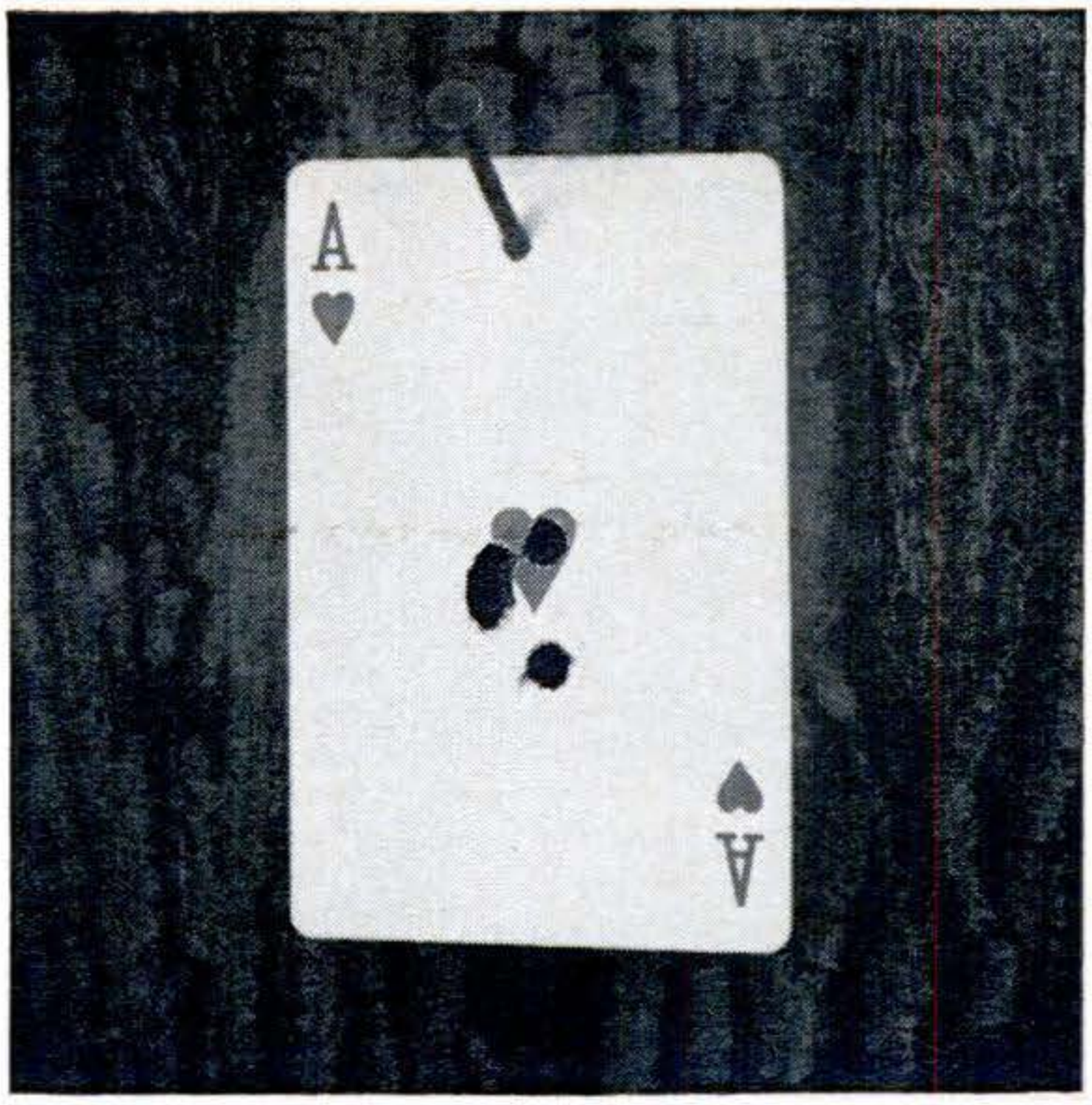

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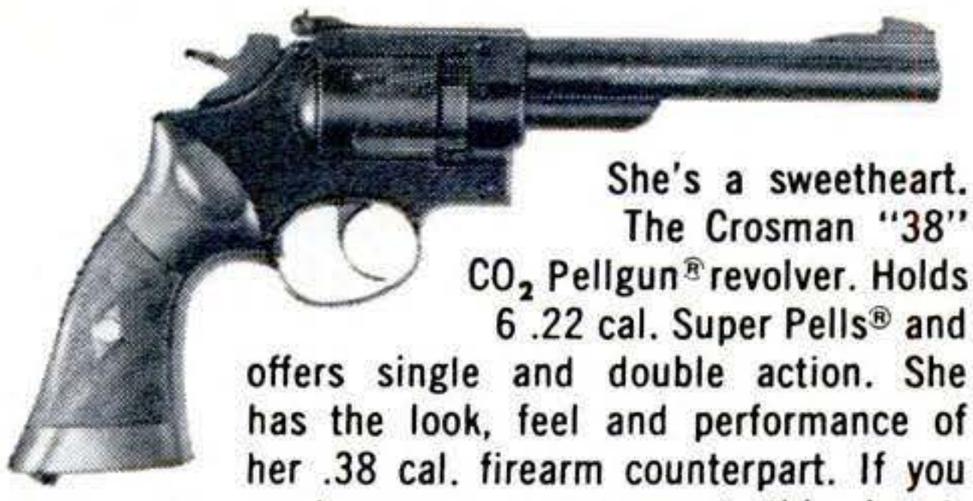

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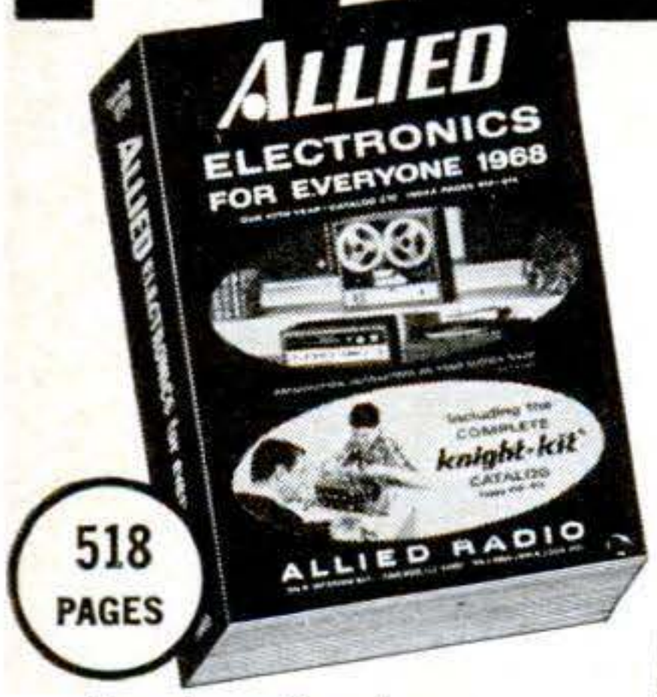

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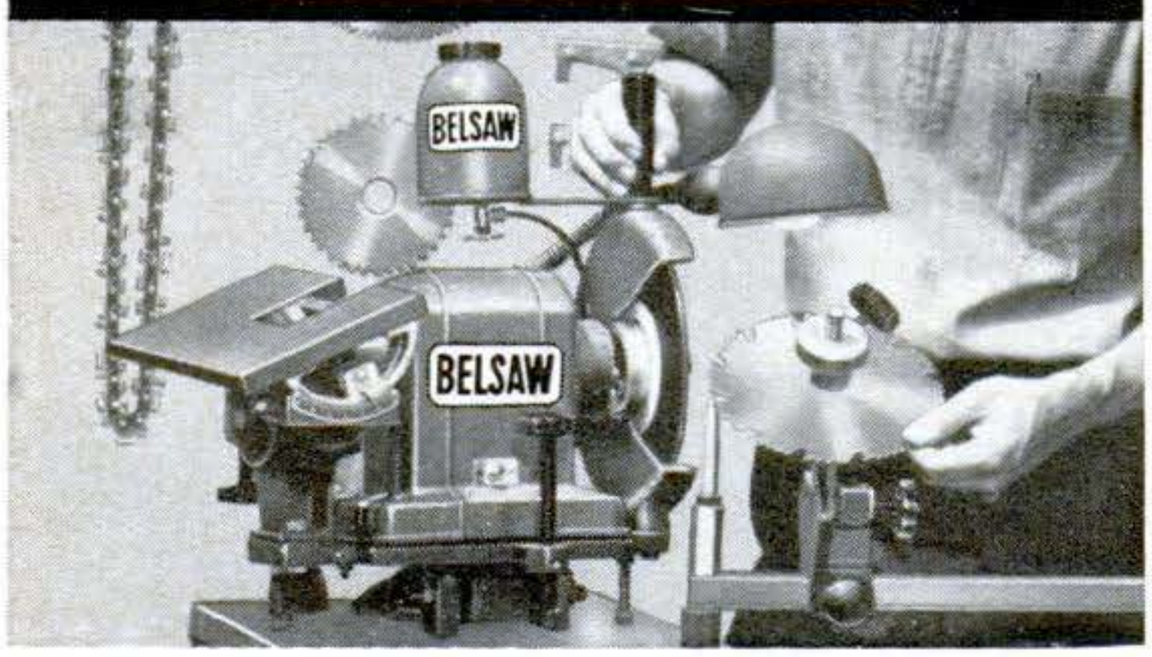

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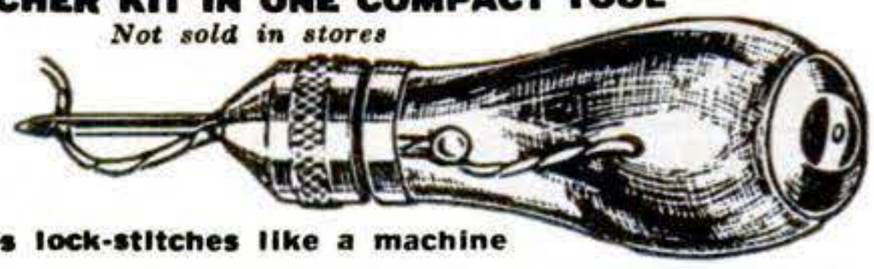

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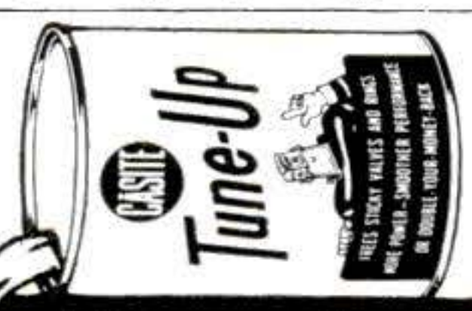

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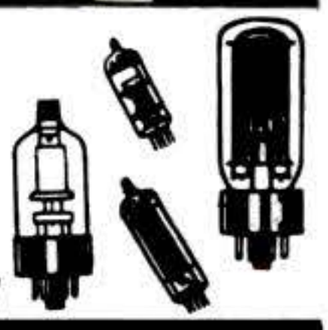

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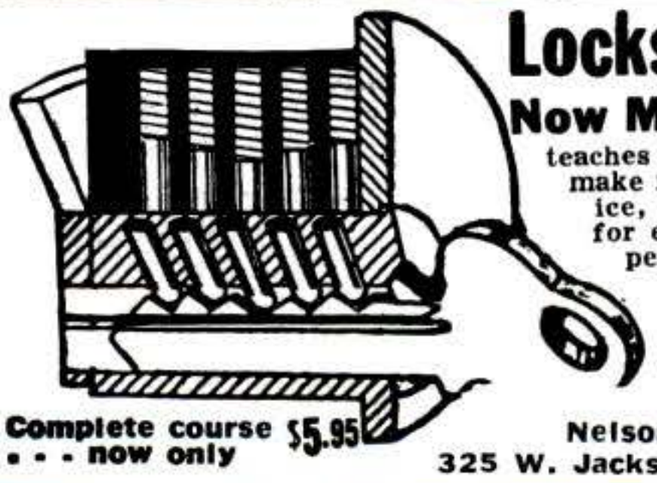

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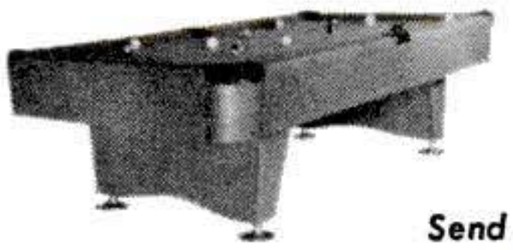

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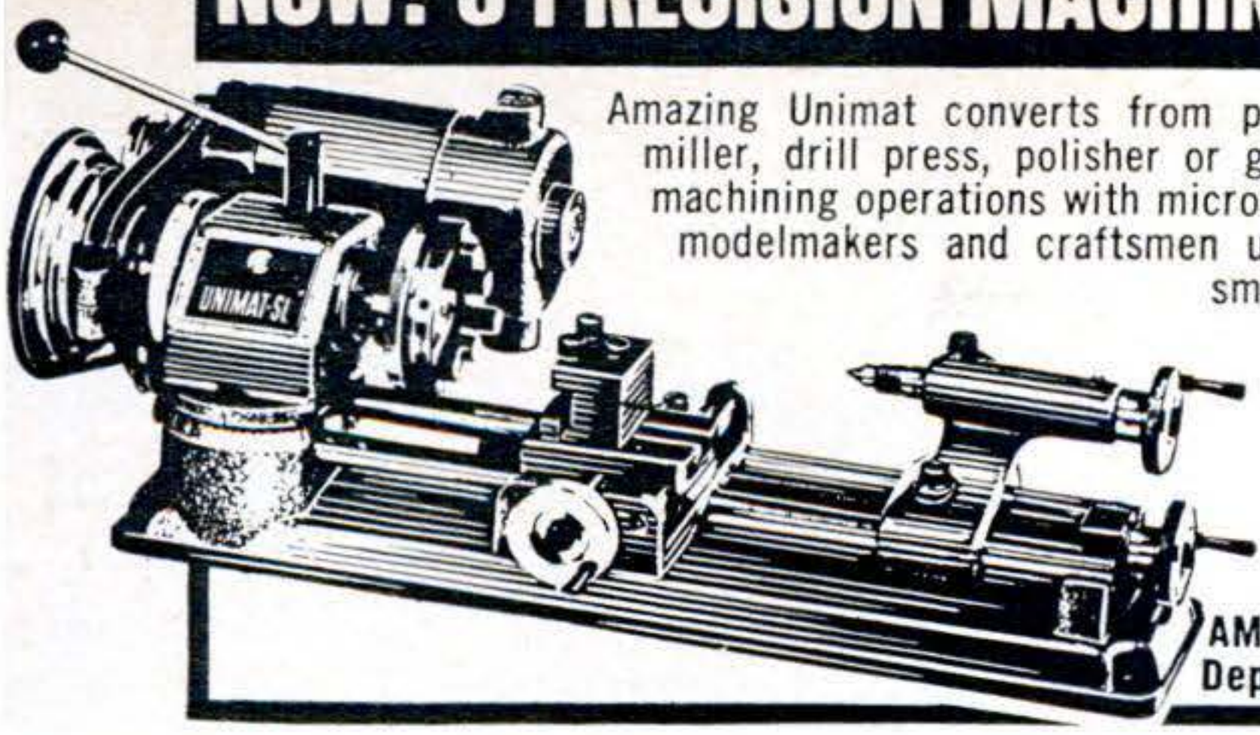

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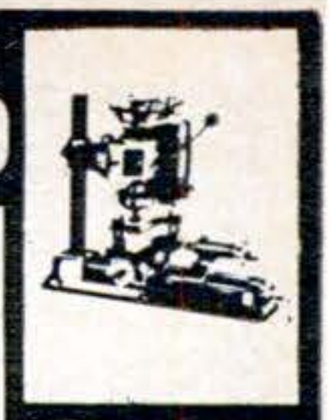

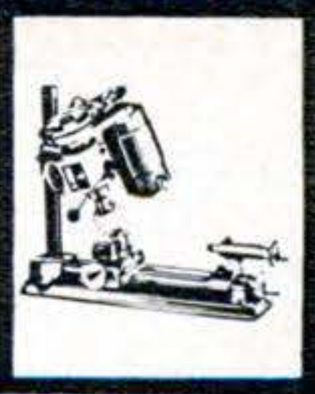

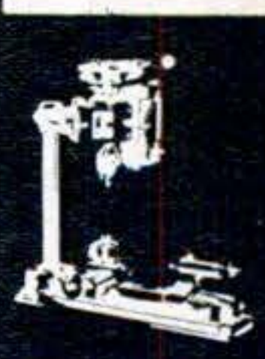

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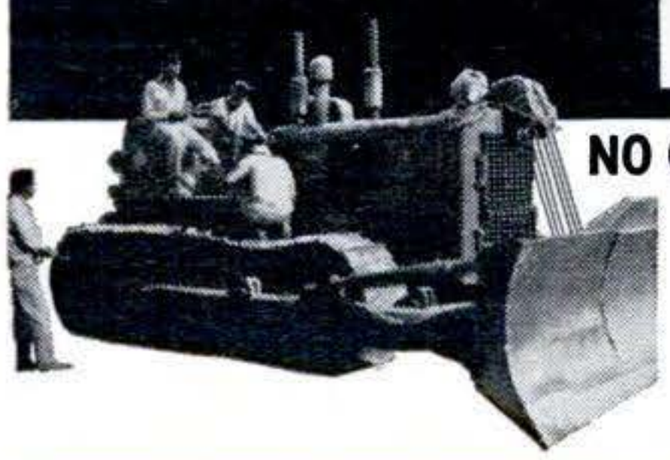

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Detroit Report...

VARIABLE-RATIO STEERING IS MAKING MORE INROADS ON AMERICAN CARS. Pontiac Grand Prix and Bonneville 1968 models now have the mild Cadillac version of VRS. But the really beneficial, low-ratio VRS systems will show up on sportier cars in the near future. Pontiac is planning to have a VRS system with ratios of 13.5:1 at center, 6:1 at ends in its Firebirds as an option next year. Lock to lock, the steering wheel will turn only 2½ times.

Electric fuel pumps are in the works for a great number of 1969 cars. One electric unit just missed being introduced on the '68 Riviera. Noise level was too high. Benefits of electric pumps—which are placed inside the fuel tanks: more precise fuel delivery, cooler operation, better evaporation control.

Pontiac pays $5 extra for that new rubber bumper on each 1968 GTO. That was the price penalty at production start-up of the '68s, and one big reason the bumper was installed on the higher-priced GTO line. Engineers figure a front bumper of steel and chrome costs $20 to $25 per unit, so the rubber version is a 20-25-percent cost increase. Pontiac plans to put a part-rubber, part-chrome bumper on the big models next year.

Controlled-collapse front ends are in the works for other cars besides Ford's. General Motors has a priority program right now that will produce front-end designs built specifically to soften front-end crashes. You'll see results on all GM cars within the next three years. Ford has scheduled the 1969 big Fords and Mercurys for a collapsible front end as its first big step toward more crash-safe cars.

A new AMX sports car may have a terrific impact on the small-sporty-car market. American Motors plans to sell the base AMX model for just under $3,000, or about two-thirds the price of the Corvette, its only U.S. competition. That's a complete car with bucket seats, V-8 engine, premium-grade interior. To remove any doubt that this will simply be a two-passenger Javelin, take a look at the wheelbase. It is 98 inches, exactly the same as Corvette's, and 11 inches less than Javelin's.

Lincoln's Continental Mark III, scheduled for introduction in January, is the first car in a separate new series of Lincolns. A four-door sedan will be brought out later. The two Mark IIIs will form the top series of Lincoln, selling for an $8,000 base price. The present Continental will make up the lower-price series, with two-door and four-door models the only offerings. A second step in this plan is to abandon the unit-body design of the regular Continental and change it to a frame-and-body design like that of the Mark III.

A nonskid braking system is the hottest development under way in Detroit. At least seven companies—GM (Delco-Moraine and Central Engineering), Ford, Chrysler, Kelsey-Hayes, Bendix, Eaton—are working feverishly on a foolproof, economical way to prevent wheel lockup when brakes are applied. You can look for the big move to antiskid in the 1970 model year with GM adopting it on all its cars at that time.

To provide extra room in station wagons, one GM official suggests an easier way than front drive. He says independent rear suspensions, where each rear wheel is sprung separately, can add lots of passenger room at a fraction of the cost of front drive. The drive-shaft tunnel would still be there, but it would shrink in size. Since the rear differential will be in a fixed position attached to the underbody, there will be no need to build clearances for the up-and-down movement of either differential or drive shaft.

Ford front fenders are thicker this year. Fender stock is made of 40-thousandths sheet steel compared with the 30-thousandths last year. The old thickness just won't take the bending styled into this year's cars. Metal was breaking off in chunks or forming ripples on the surface as it was being formed in the press plant.

Jim Dunne

Detroit Editor

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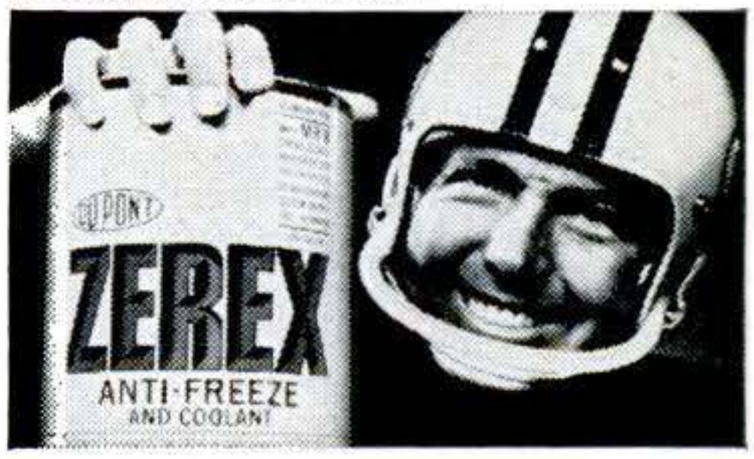

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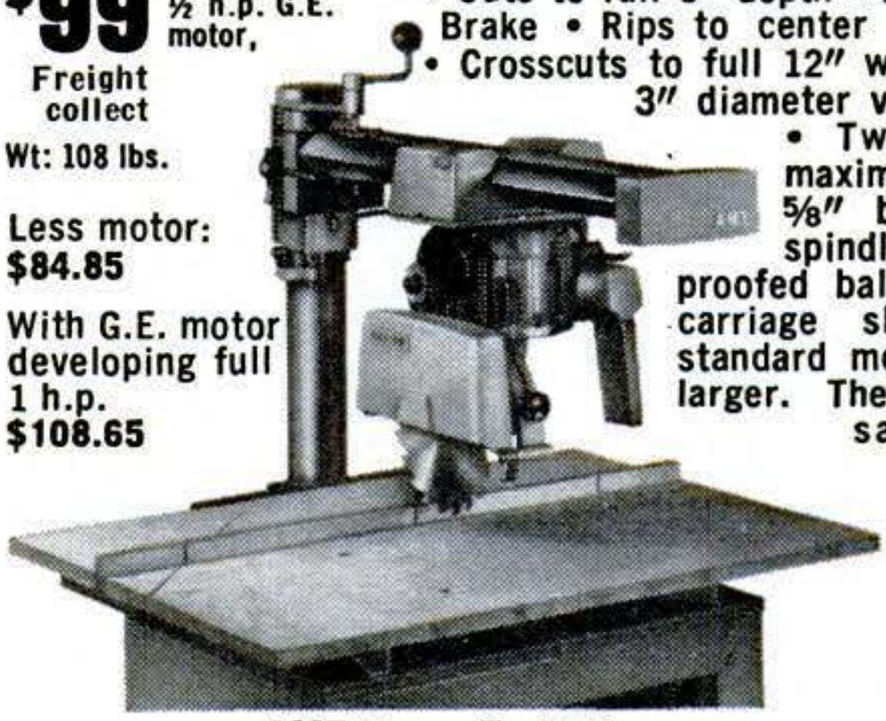

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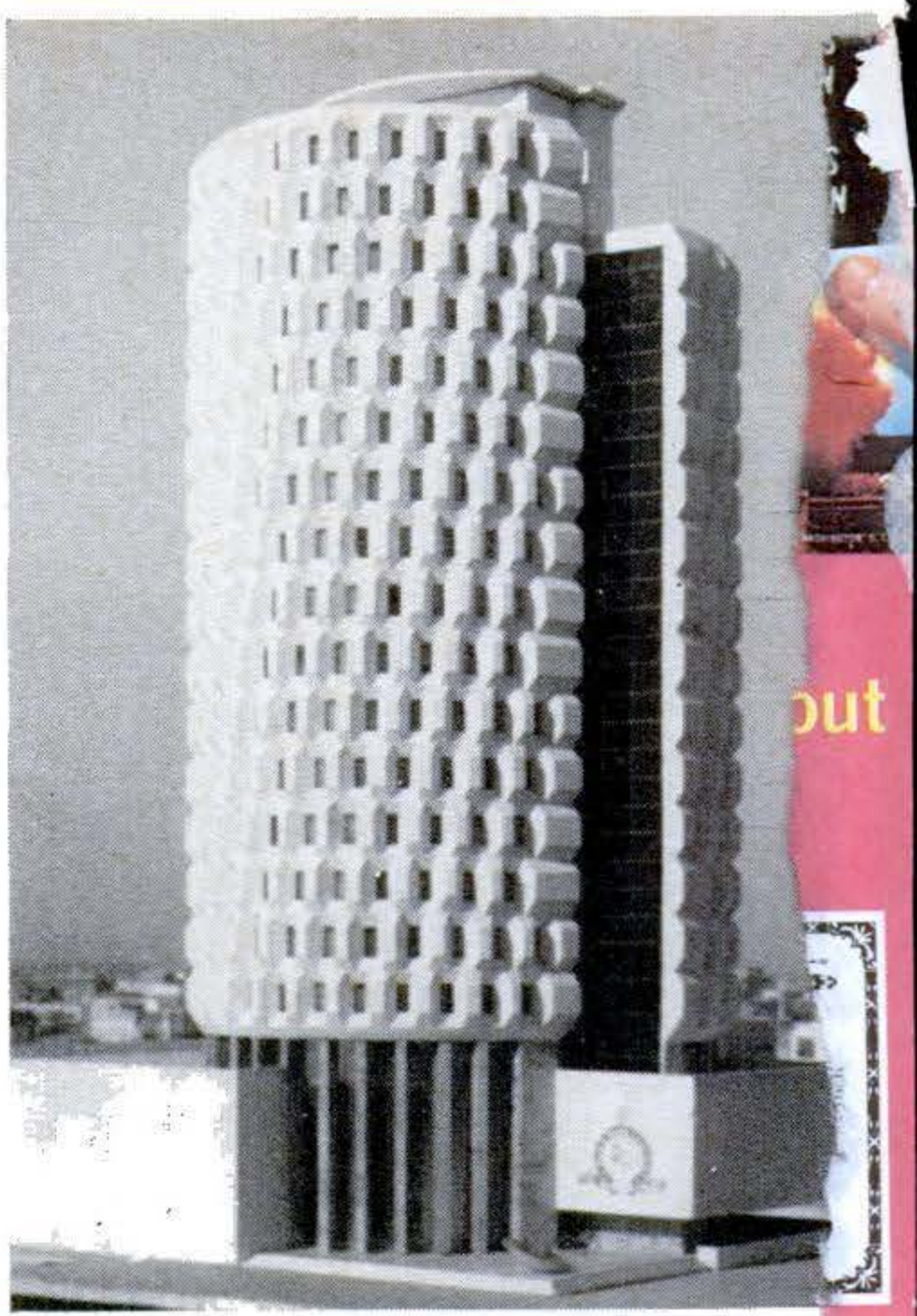

Better by half again

Looks as if someone had sliced o pineapple top and bottom, then spl doesn't it? It's a new bank in hot Ka Pakistan, where doing it by halves it easier on the air conditioner. Th inside faces—all glass—shade one an and windows in the curved walls are tiny to cut down the sun's load.

Fishy idea for old street cars

Fishermen in Redondo Beach, Calif. knowing fish like hideaways as homes, had an idea. The anglers induced the city to dump some old Los Angeles street cars into the ocean as an artificial reef. It worked. Wet your line there sometime.

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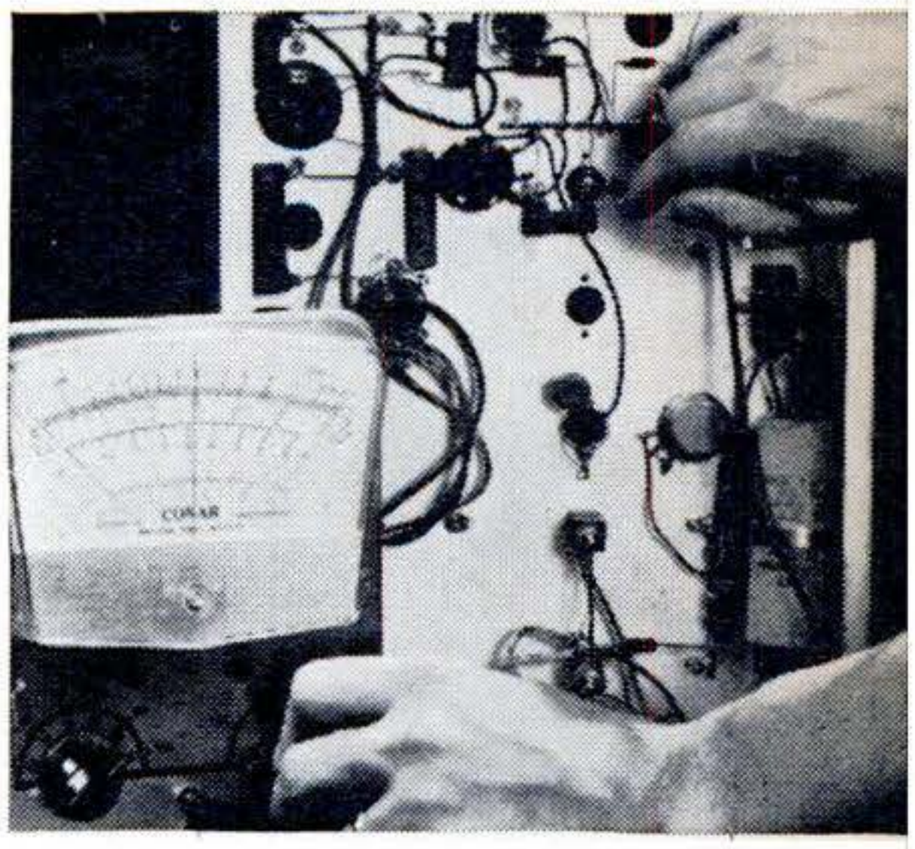

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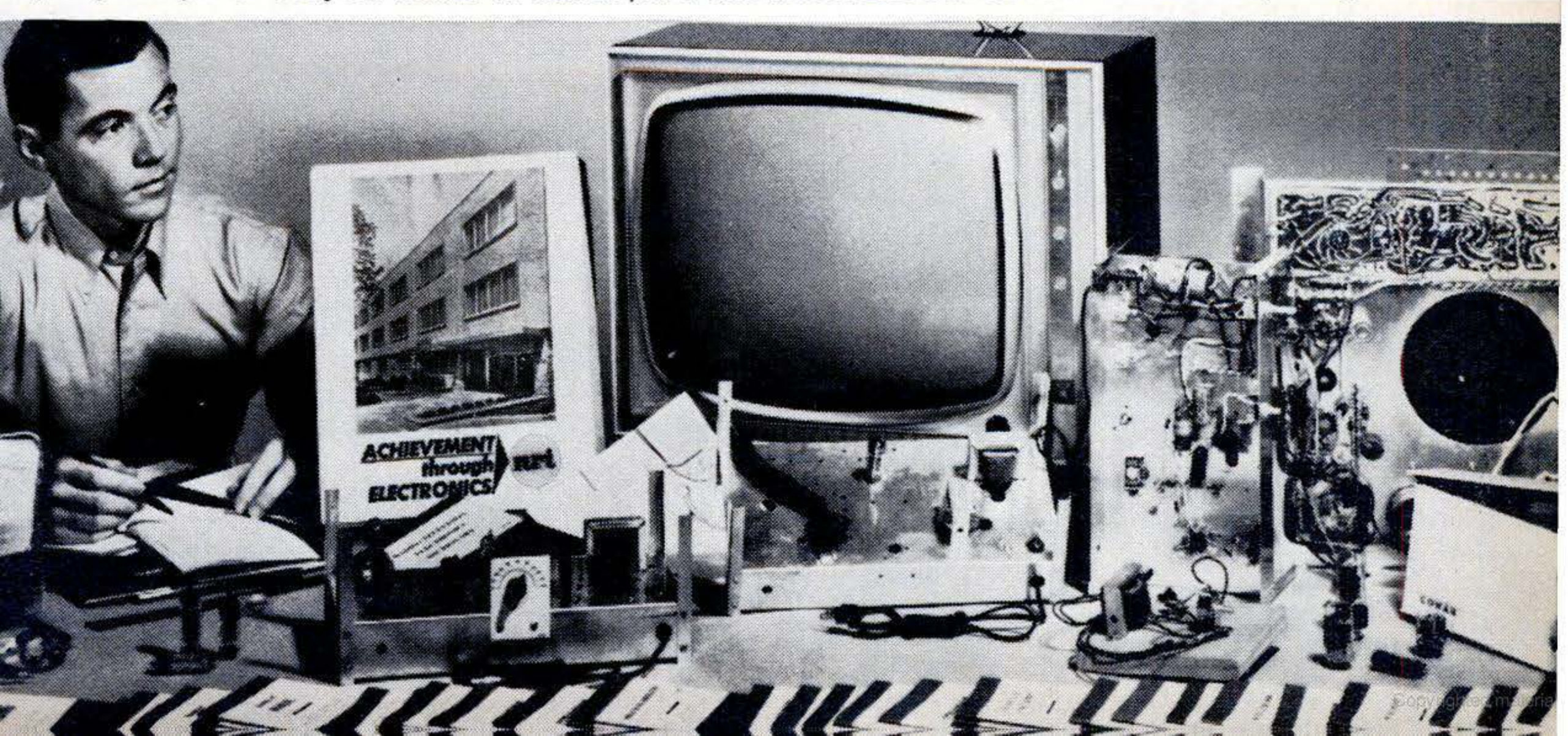

New, imp

Alas.

As big and lovable as it was, there were still some things some people didn't love about our old wagon.

Some people weren't too crazy

So we re-built the Volkswagen Station Wagon from the bottom up and now it rides just like a car.

Some people weren't too crazy about the way it looked either. "No class," someone else said.

"It's not the most comfo on earth," was another con

So we made it more c The inside is nicer. There' than ever before for up Just about everything's

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oved box.

e seats, more plush.

"The front doors are too narrow t too hard to get through."

o we made the front doors wider e easier to get through.

"The side doors get in the way when oading," someone said.

So we put in a huge 3½' by 4' sliding side door. Slide the door open. Slide the piano in. Slide the door closed. (It locks automatically in both positions.)

"It doesn't have enough heater and vent outlets." So now we have 6.

"It has too many little windows."

So we built giant ones. "The windshield wipers are too small." So we built giant wipers (to go along with the giant windows). "It's kind of homely," someone finally said. "Can you make it beautiful?" Done.

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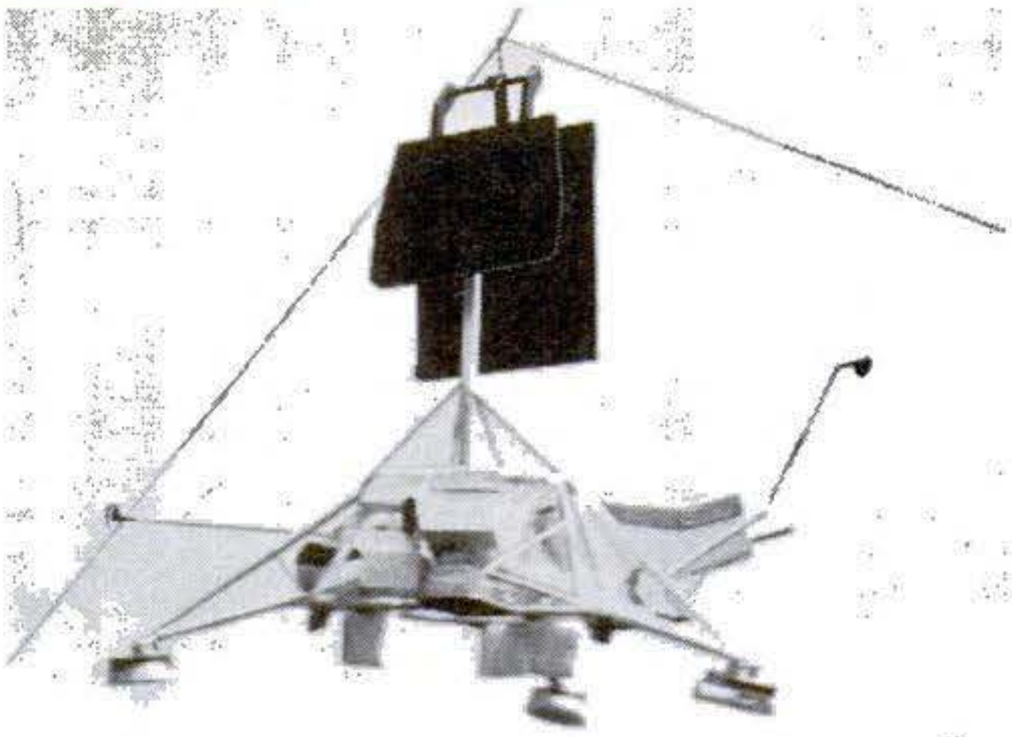
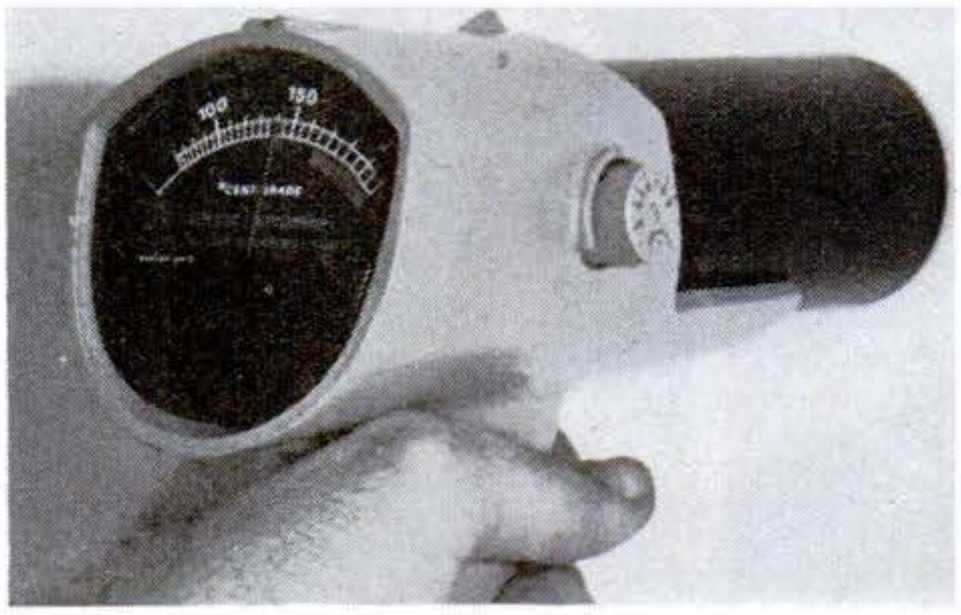


Do-it-yourselfer makes a Surveyor

A 17-year-old Oswego, N. Y., high-school student built this scale model of a NASA moon Surveyor using half-inch maple dowling, glue, bathtub caulk, foam rubber, table-tennis balls, and cork fishing bobbers. Hughes Aircraft was so impressed with Ron Lagoe (left, above) that it gave him a scholarship.



A gun? Yes, to get temperatures

It looks like a pistol with a king-size barrel. Actually, it's a thermometer that registers the surface temperature of any object, without contact, from 60 to 3,000 degrees. It responds to infrared energy emissions. Made by the William Wahl Corp., it's called a Heat Spy.

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Grab a Skee-Horse by the tail and hang on!

Our new Light-Trac 15 is a cross of greyhound and husky — far lighter than ever before, but not a whisker less strong. Its new self-cleaning track, a solid loop of molded polyurethane, provides surer traction for faster action. Sic 'em! Just snap that 16-hp American-built engine into powerful life . . . exclusive compression release assures quick, easy starts. ■ Now hear this! This first "second generation" snowmobile is first with full-range silencing — the quietest on the winter scene. Other Skee-Horse specifics include Torque-Sensor drive that gears itself automatically to changing hill and load conditions . . . neutral lockout allows warmups at a standstill . . . two-cylinder homing insurance (you can run on one) . . . nearby dealers when you need parts and service fast. We invite your comparison! See the Johnson dependable Skee-Horse Light-Trac 15 and Wide-Trac 20's at your dealer's. Or write for free catalog. Johnson Motors, Waukegan, Ill. 60085, Dept. PS-S82

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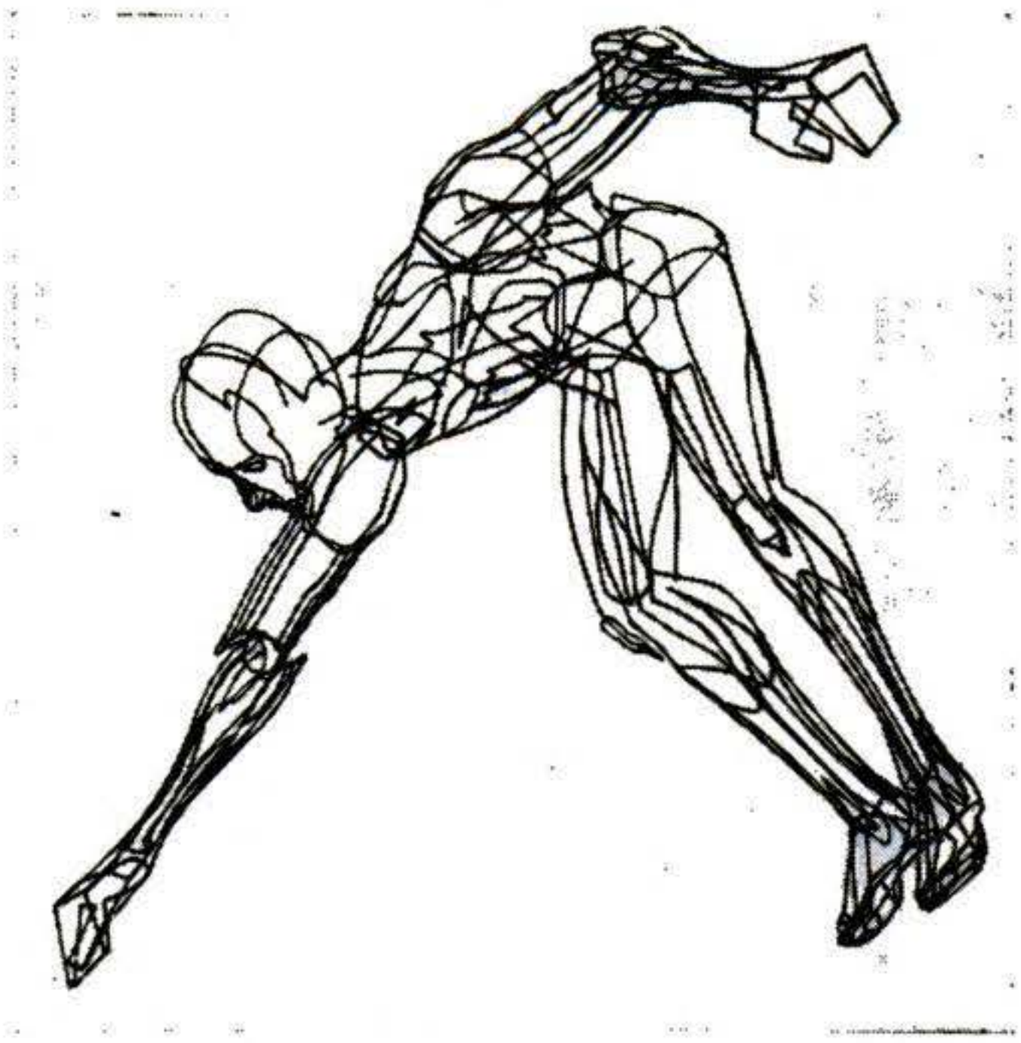
Pedal power works high-speed pump

Leg muscle operates this inexpensive water pump, designed for use in underdeveloped lands. Capable of lifting water 22 feet at 14 gallons a minute, it won for John R. Frassanito of the Art Center College of Design, Los Angeles, the 1967 Alcoa student-design merit award.



Computer makes electronic drawings

That versatile business aid, the computer, is being used now as a tool in visual aids. Data is fed into the intricate innards of the thing, and out comes a drawing like the one above—which could be a football lineman, a floating astronaut, or maybe a suburbanite just picking weeds.

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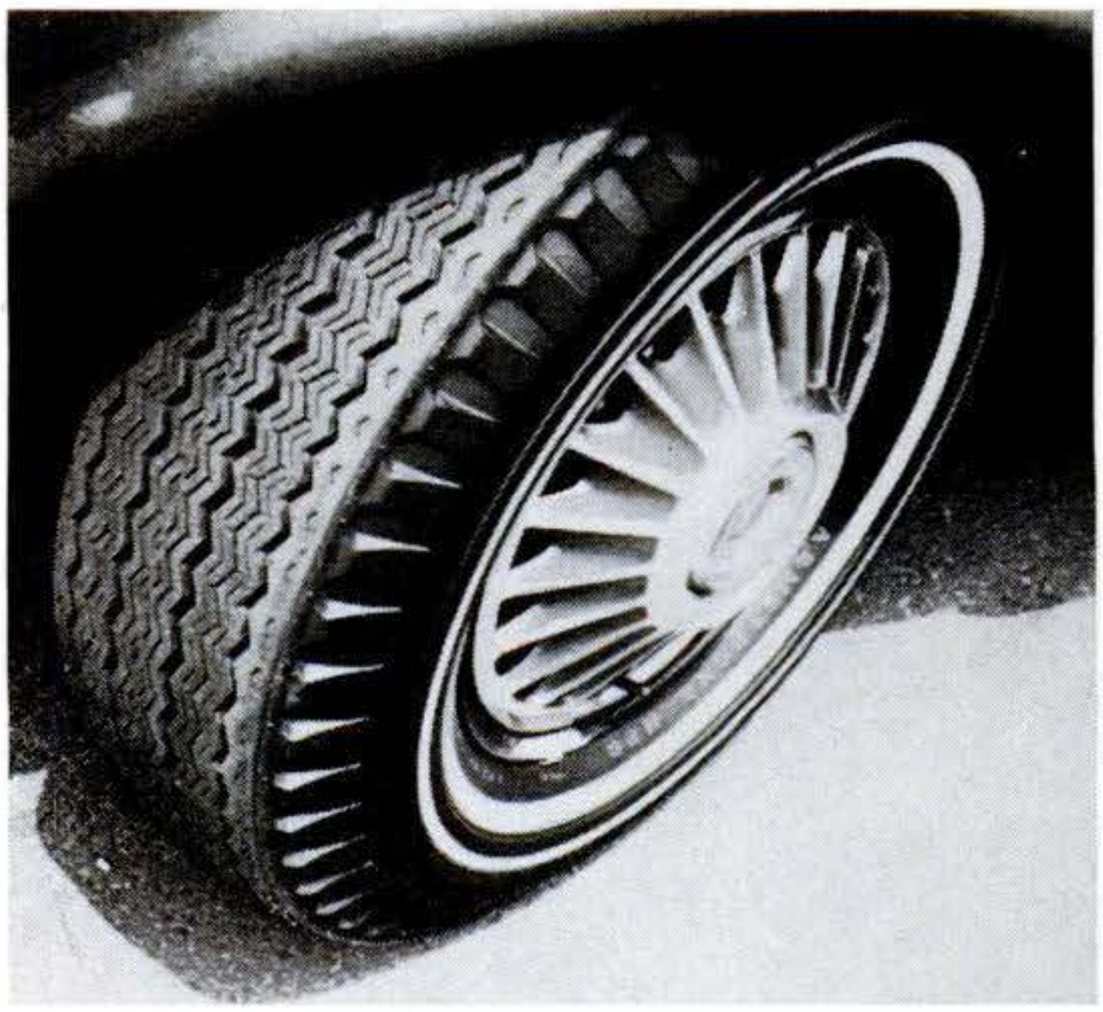
You can stop wearisome waxing—put a plastic sheet over your car

The shine on that five-year-old Ford you see above came from the application of Plasticon, a new acrylic-plastic coating. It goes on like ordinary liquid clean-and-wax preparations, but leaves a hard layer of plastic over the paint, filling in the paint pores and locking out dust and dirt. One application will last a year, says the maker (Plasticon Chemicals, 47-38 Fifth St., Long Island City, N.Y. 11101).

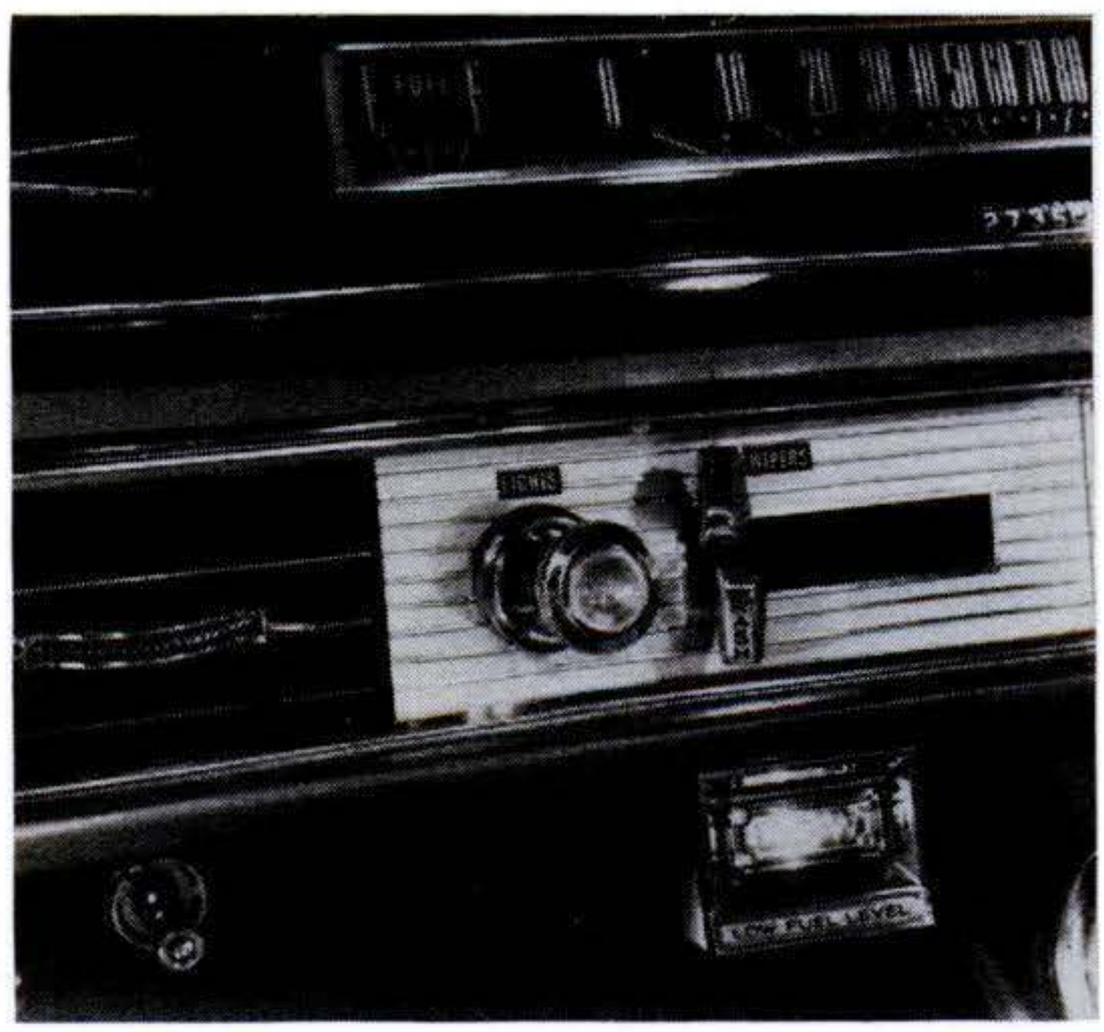
The "before" photo was taken last March; the "after" photo, in August—two Plasticon applications and several washes later. Because of its badly oxidized surface, I had to give the car two treatments to build up a solid plastic coat that didn't wash away. I also found that the coated surface seemed to resist stains better than an ordinary waxed one. Plasticon takes off dirt without heavy rubbing. The maker claims it will even remove road tar.

Each treatment took me only 45 minutes. I used a full can ($3.60) each time. It's almost like buying a garage in a can, since salts and air-pollution chemicals won't attack acrylics, and rain (or even detergents) won't wash it off. The coating doesn't crack, peel, or yellow and you can apply it all over a car to protect and clean it—on chrome as well as paint.—*Herb Shuldiner.*



Tough new high-performance tire

It's called Armstrong HPG and is identified by red and white stripes on the sidewall. The wide and flat tread has vents for cool running and long life. The tire improves traction, braking, and stability.



Light warning for the absent-minded

Someone in your family always running out of gas? That's why Rite Autotronic's Gas Watch was born. It flashes a LOW sign when the tank is down to a preset level, stays on until gas is added. About $5.

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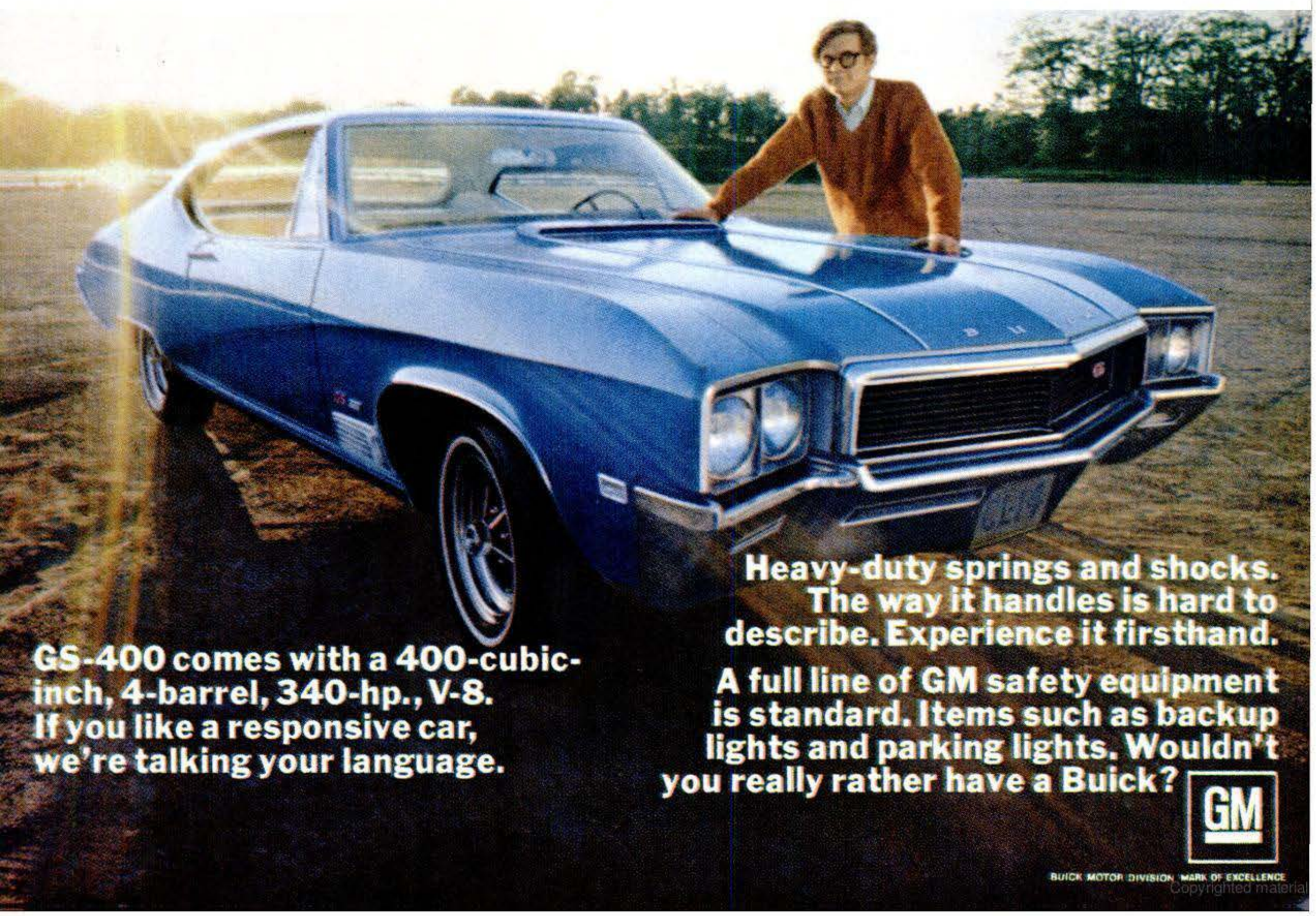
'68 Buick. Now we're talking your language.



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SMOKEY YUNICK:

When Stock Cars Don't Finish...they tell about your car's weaknesses

To the men in racing, the name Smokey Yunick is as familiar as that of any glamorous race driver. He was the mechanic behind one winning car in the Indianapolis 500 race, and his skills have helped put others in the money there. Many stock cars, too, have roared first across the finish line with engines and chassis reconstructed, streamlined, and pretested by Smokey. All this, plus his experience as a truck dealer in Daytona Beach, Fla., have made Smokey the best-qualified mechanic in the United States – and the most famous. No man, anywhere, can talk more knowingly about why cars – including yours – break down.

By SMOKEY Himself

When an engine blows sky high in a stock-car race, usually in 1/100 of a second, spectators often wonder what happened and why.

A lot of the failures in stock cars on the competition tracks can be related to the failures in your own family automobile. In racing, the weaknesses show up faster, that's all. In this article I want to explain:

- Why engines blow up.

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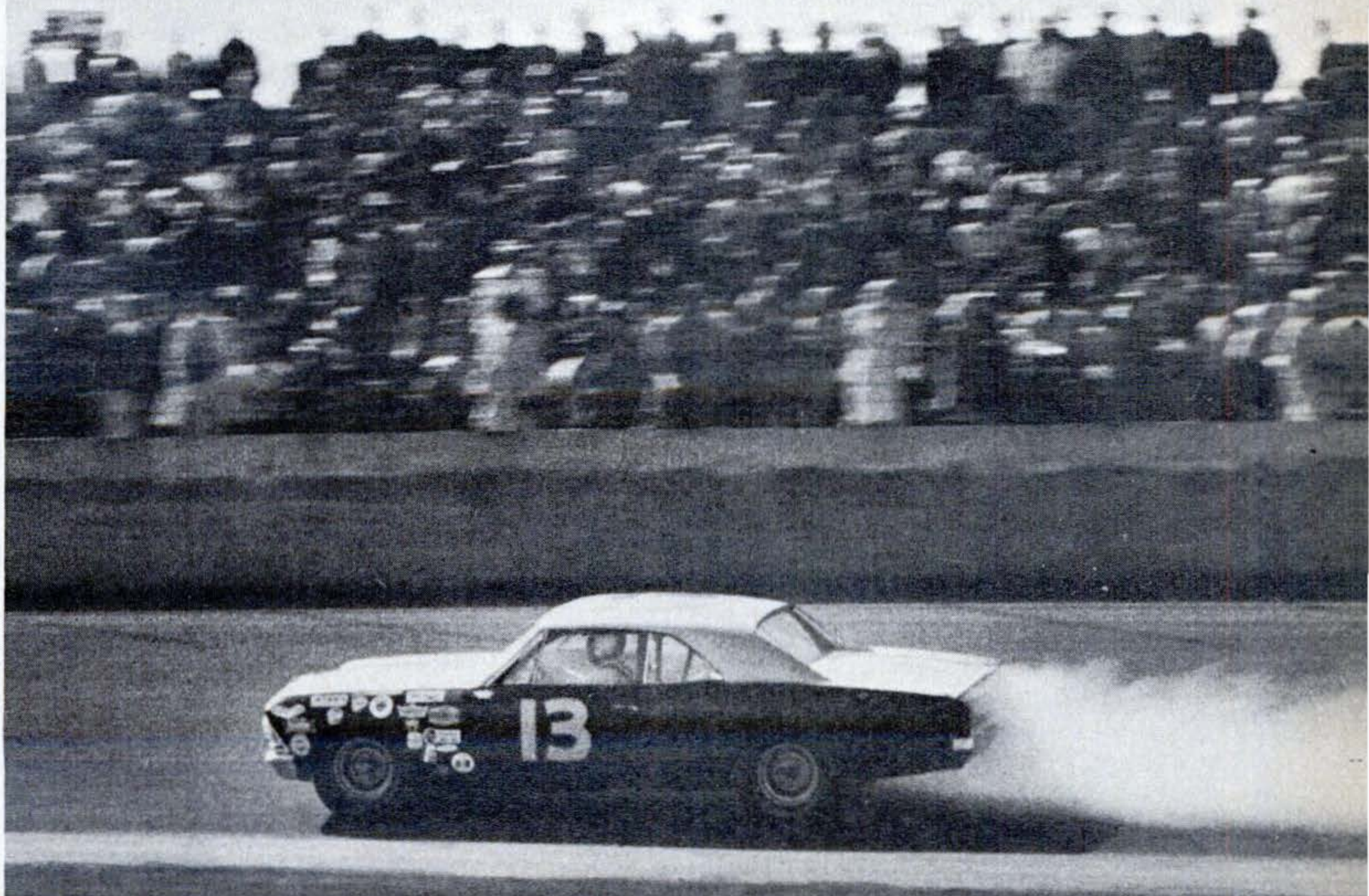
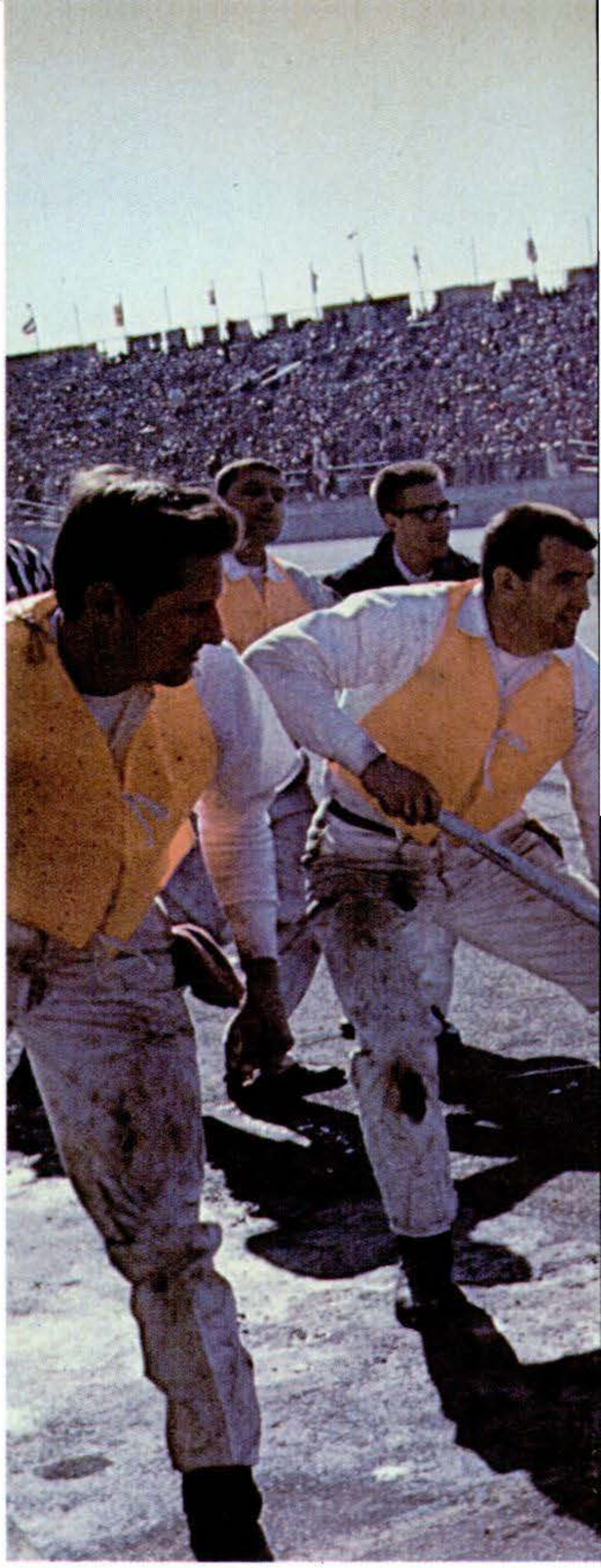


Curtis Turner burns out engine of Smokey's Chevelle in Daytona 500 race.

"Stockers," despite considerable modification after they come off the production line, are still close kin to the car you drive, and their troubles can pinpoint ways to anticipate your own breakdowns



LEVITON-ATLANTA

- What components usually fail first.
- What components give race drivers the least trouble.
- What trouble signals drivers watch for.

Now and then I'm going to mention failures at Indianapolis and in road races, but only for comparison with stock cars and your own family car.

I'm also going to let you in on a few tricks of the trade. Do you know why, for instance, a driver who is leading a race will suddenly drop back for a few laps?

Okay, fasten your seat belt and hang on: Here we go.

The most common reason for stockers dropping out of races is accidents. A man hits a wall or another car, or a sudden spin in oil dropped on the track by a competitor damages his car—or costs him so much time that it's useless to go on.

But we're not concerned with accidents here. We're talking about the cars themselves. So let's start with engines. That's where, of course, most of the trouble occurs.

The causes of engine failure seem to go in cycles. Back in the early days of stock-car racing, when we turned our engines at relatively low r.p.m. – and the materials in them weren't as good as they are today – we lost a lot of engines simply from wear. We didn't have good air cleaners. On the dirt tracks an engine ate so much dirt it wrecked its rings and wore out the cylinder walls. That led to other troubles – it began burning oil, fouled its plugs, and lost power.

Godsend: paper filters. That's not true today. The paper air filter was a godsend. If a filter doesn't get a hole in it, we've got no problem with dirt getting in through the carburetor. We don't clean filters. That might rupture them. We just replace them for every race. Let me say in passing that Indy cars don't filter their air. A $25,000 engine's induction system is wide open there. But it's a short race—as compared, say, with the 12- or 24-hour races at Daytona, Sebring, or Le Mans – and it's a paved track with little dirt. They actually vacuum-clean the track before the race.

So that's a lesson for you – watch the condition of your filter.

The chrome compression ring is another

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Richard Petty's pit crew swarms over his Plymouth in Daytona 500 stock-car race —won by Mario Andretti in a Ford—this year. On the PS cover, incidentally, the half-sleeves worn by the pit crew are a violation—as sometimes happens—of racing rules.

good development. It doesn't let the dirt wear the cylinder walls. It shoves it back out the exhaust valve.

Bearings are better in the stockers and in your family car, too. And if dirt enters the oil system, it's quickly taken out by much better filters than we used to have instead of floating around and eating away at the bearings.

But bearings do fail, and in a race an engine may blow—and I mean blow. They explode. From 50 to 90 percent of an engine may be destroyed. This is a new thing. Ten or 15 years ago, in stockers, or even at Indy, few drivers wound their engines over 6,000 r.p.m. Stockers usually made about 5,000. If a bearing started to go, a driver would feel a vibration and head for the pit. The game was over, but he was intact.

Continued

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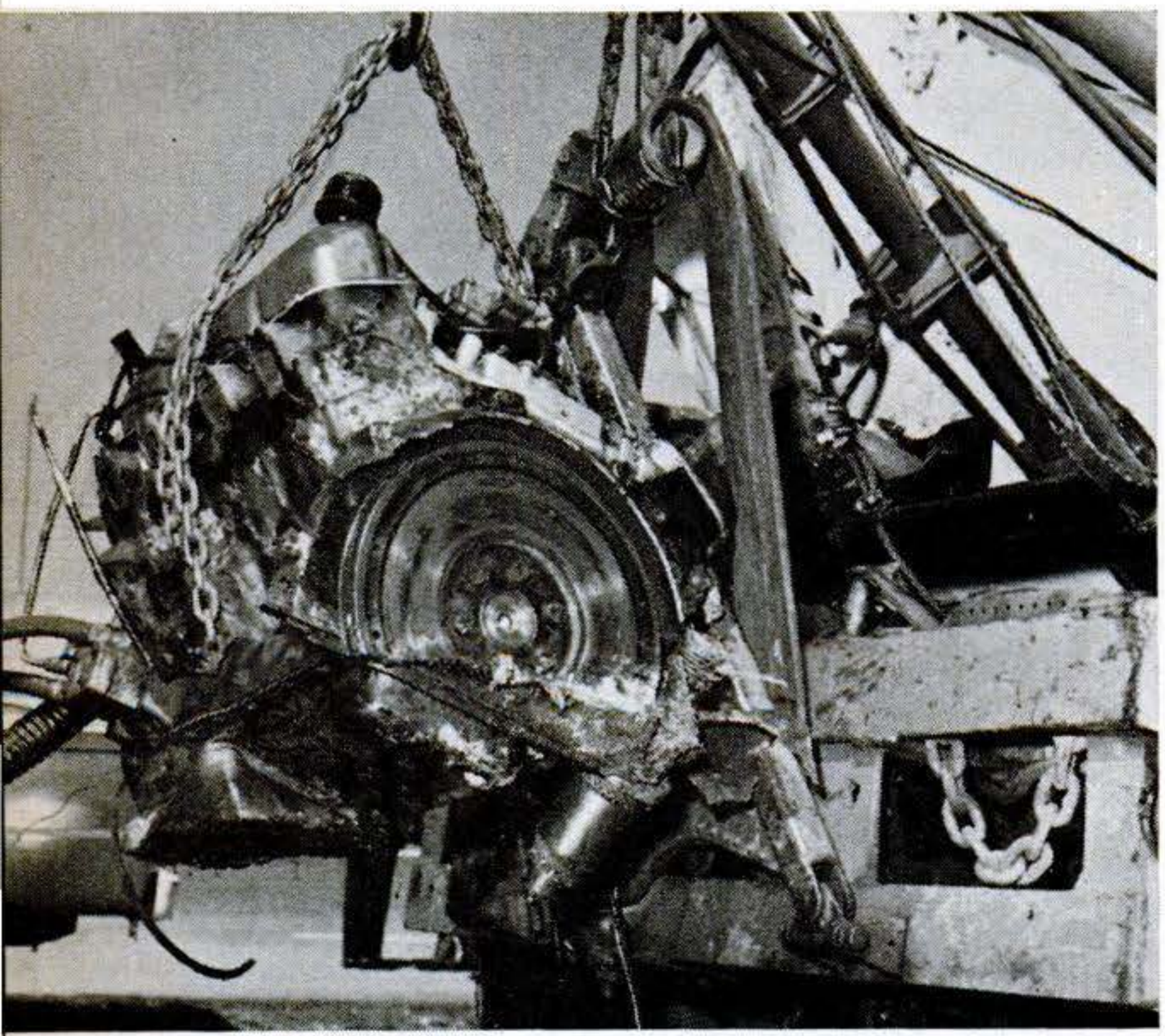
Excess heat is the usual cause of failure in most components

But today, most stocker engines, even up to the 430-inch size, turn at 7,000 r.p.m. or more. Indy engines turn at 8,000 and up. For the four-cam Ford, 9,000 is a nice, round figure for the entire race. Even the supercharged Offenhausers reach 8,500. At that r.p.m., a driver can't recognize trouble and get off the throttle before the damage is done.

If a bearing goes, it usually causes a failure in the crank or rod assembly—pistons, wrist pins, rods, rod bolts, or caps—and you can imagine what that does to the engine at that speed. Another thing—the reciprocating weights of the pistons and rods often cause a rod to break in half. This probably knocks as many cars out of a race as anything else.



"Clutches don't wear out—centrifugal force throws the lining off from overwinding. Or sometimes pressure plates and flywheels simply explode . . . Nobody . . . has used an automatic box successfully."

Valve-system failure. This is the other big engine-wrecker. They've improved metals tremendously, but, in a race, valves go up and down a lot faster than normal. It's not uncommon for a valve head to snap off, or a valve spring to break, or a pushrod or cup to go. The engine can blow sky-high here, too. Part of the valve system gets tangled up with the pistons, and that's all, brother!

Let me add real quick that this hardly ever happens in the family car.

The average passenger-car spring holds a valve on its seat at about 90 pounds of pressure. A racing car uses 130 pounds. In the open position, the spring pressures range from 275 for the passenger car to 330 to 400 for the racer.

Stockers seldom burn valves. At high r.p.m. a leaky valve doesn't seem to affect power output much. In your family car, it's another matter. A leaky valve at 2,000 r.p.m. spells trouble.

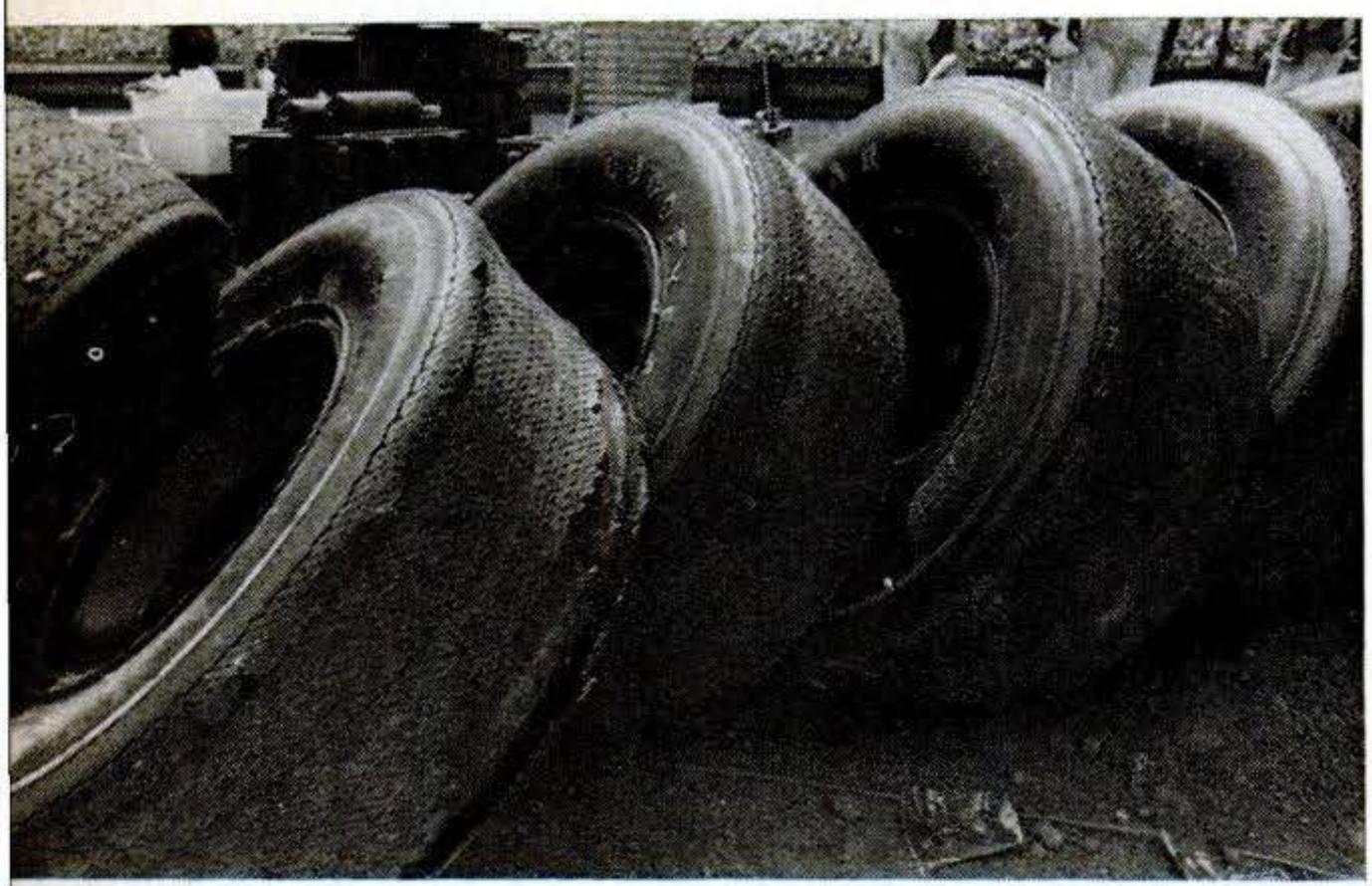
Cams seldom fail after a race starts unless there has been an engine change and the cam was in trouble to begin with. At one time, cam failure was a big problem. The lobes just wore off.

Don't worry about such failures in your own car if you observe the manufacturer's instructions and you don't remove the break-in oil too soon.

We don't often bend pushrods. Once in a while a piston may hit a valve so hard that the whole valve action is driven back down against the cam. At that point you can bend the pushrod *and* bend or break a valve.

Overheating is a common cause of racing engine failure. Stocker engines are real borderline on heat rejection. The reason: To save weight (and we're limited on space, too) a man doesn't want any bigger radiator than is necessary.

We operate about 30 degrees hotter than the family car. Most stock racers



"When a driver's rubber begins overheating, he begins losing lateral stability—he slides more in the the corners. When a tire gets around 300 degrees, he gives first place to anyone who wants it."

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would hate to run over 210. We try to stay around 180 or 190. For the driver, what it amounts to is watching the *rate* of heat buildup. If he's at 190 in 10 or 15 laps and still going up, he gets worried. But after 100 miles, if he's at 190 or 200 and stays there, he's okay.

Engine temperature is a function of r.p.m. If a driver starts getting too hot, he slacks off on the accelerator—just as you'd slow down if you began overheating at 75 m.p.h on the Mojave Desert in July. It's one reason that you'll see a driver who's leading a race drop back to third or fourth place for a few laps. He has to cool off.

Oil temperature—big bugaboo. For racing, we have to carry an oil cooler. Production automobiles don't. Racers have to carry much more oil because the drainback is too slow, and four or five quarts of oil are up in the top of the engine.

Few drivers burn bearings on the track because of simple oil-system failure. Bearing failure is usually tied in with a reciprocating part failing, or high oil temperature for many reasons—mostly too much r.p.m. When the oil gets over 300 degrees, it's sudden death for any engine.

Overheating causes ignition failures, too. Most racers now use transistor ignition, and it is greatly affected by temperatures over 150 degrees. The amplifier usually starts to lose its control at this point.

Ignition failure is still a pretty big factor in the outcome of stock races. It all seems to come down to the distributor. Some manufacturers design too much load onto it. The distributor drives off the cam, of course, but the distributor *package* drives the oil pump. In racing, you have to supply about 14 gallons of oil a minute to the engine. That's quite a load for the pump, and it reflects back on the distributor.

In the family car, ignition failure is usually due to something other than the distributor. With *good maintenance,* ignition failure in the family car is rare. Transistorized breakerless ignition, with no points to worry about, is the better way to go, but it's even more critical given high temperatures, poor maintenance, or abuse.

Personally, except when the rules allow magnetos, I prefer transistors for two basic reasons—low weight and simplicity. I prefer a magneto at Indy.

Fuel problems. Fuel delivery is less of a problem in racing than it used to be. And fuel-system failure hardly ever affects your own car. If a failure occurs in racing, it's because of the load. With a stock racer consuming about 300 pounds of fuel an hour, the operating arm breaks, the diaphragm gets ruptured, or the pump gets partly plugged.

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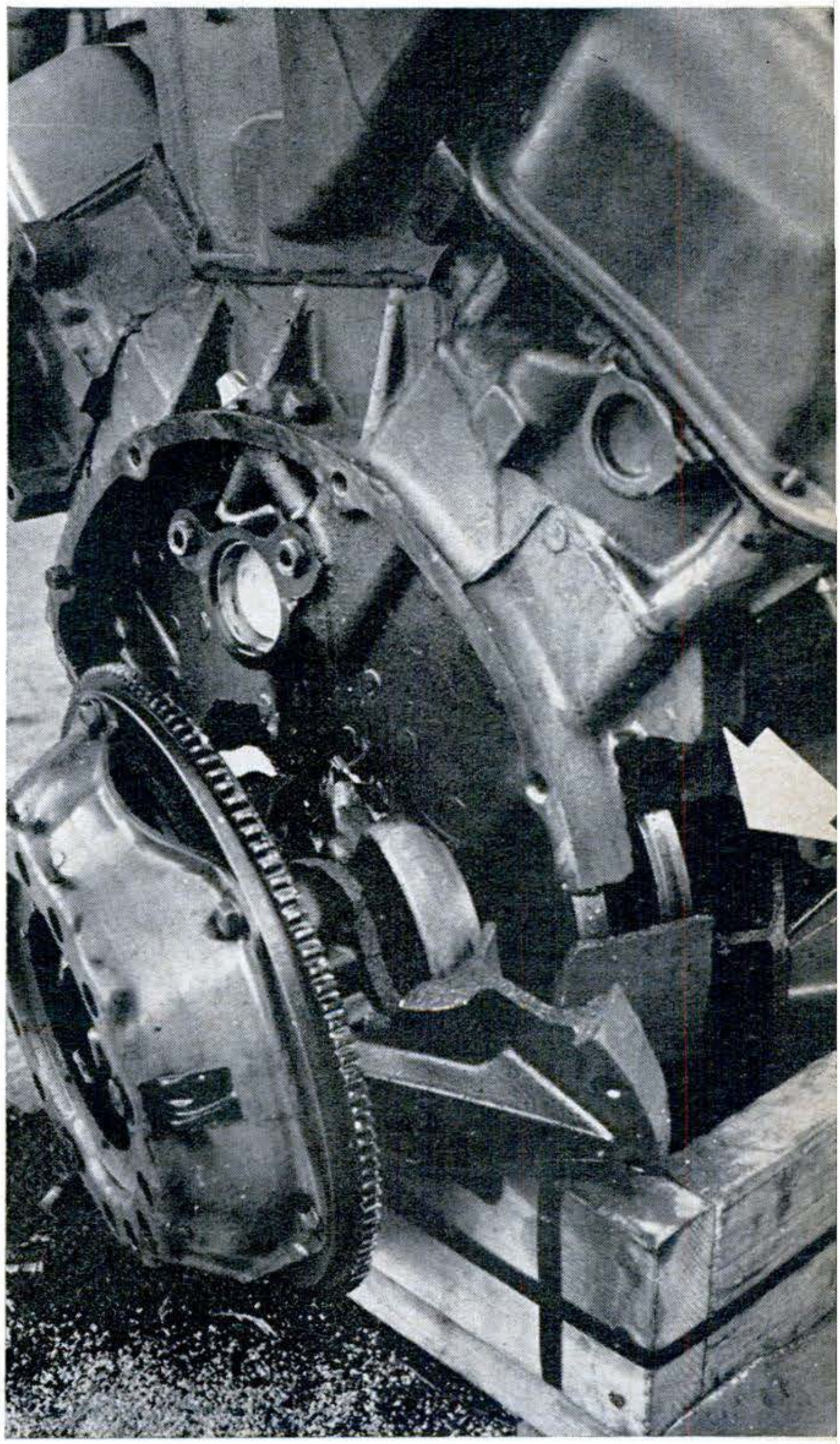

"We are breaking blocks . . . When we examine a blown engine, the damage is so great, we don't know whether a rod cracked or broke first, or a bearing started to let go, or a main-bearing web let go."

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Four Years After the Kennedy Assassination:

COULD IT

Posted on a rooftop overlooking town square at Gainesville, Ga., a federal agent armed with carbine keeps watch during presidential visit. Two-way radio alerts agents to all movements of President's party. Upper right: The recent conference between Mr. Johnson and Premier Kosygin at Glassboro, N. J., provided anxious moments for the Secret Service.

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HAPPEN AGAIN?

Have serious gaps in Presidential security, revealed by the Warren Commission, been closed? Here, for the first time, is the story of how technology and new techniques guard the President

By DAVID KRASLOW
News Editor, Washington Bureau, Los Angeles Times

Four years after Dallas . . . could it happen again? Why were the security measures taken to protect the late President Kennedy not effective, and what has been done since to guard President Johnson? *Could* another President die without warning before a sniper's gun?

On the fourth anniversary of the assassination of John Fitzgerald Kennedy, the Secret Service has a new, more expensive—and efficient—look. And Congress seems eager to continue giving the Service the wherewithal to fulfill its primary reason for being—to protect the President of the United States.

The number of Secret Service agents has roughly doubled (to about 650), as has the annual budget (to about $17 million). The Secret Service's protective intelligence files on persons in various cities judged to be potential threats to the President have been computerized. Data that would normally take a week to compile are printed out electronically in less than five minutes.

One change that doesn't show in any federal budget almost guarantees that what happened in Dallas couldn't happen again—not that way, at least.

President Kennedy and his Vice President, Lyndon B. Johnson, were riding in open cars, in a slow motorcade, on Nov. 22, 1963. Mr. Kennedy was an easy target for Lee Harvey Oswald or any other disturbed or deranged individual who had some competence with a rifle. President Johnson hasn't ridden in an open car in public since that day.

Mr. Johnson has since used the same Lincoln Continental Mr. Kennedy occupied in Dallas. But not before the Ford Motor Co. (which leases the car to the government at a nominal rate of $500 a year) rebuilt it to make it bulletproof. Assisting in the rebuilding, done to Secret Service specifications, was Hess and Eisenhardt of Cincinnati, a custom-body firm that participated in the construction of the car in 1961.

The detachable plastic "bubble top" that was part of the car's equipment before the assassination was not bulletproof. Yet some officials feel that if it had been on, there might have been at least a chance of deflection of the bullets from Oswald's high-powered rifle. In any case, the car now is heavily armored and has a bubble top of clear, bulletproof glass. A detachable black-vinyl cover for the bubble top provides the privacy of a

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limousine, shielding occupants from view.

In addition to the armor plating—much of it along the bottom and underside of the car to guard against a booby trap or grenade—the rebuilding job included a new high-performance V-8 Lincoln engine, and new heavy-duty transmission, suspension, steering, brakes, axles, and tires.

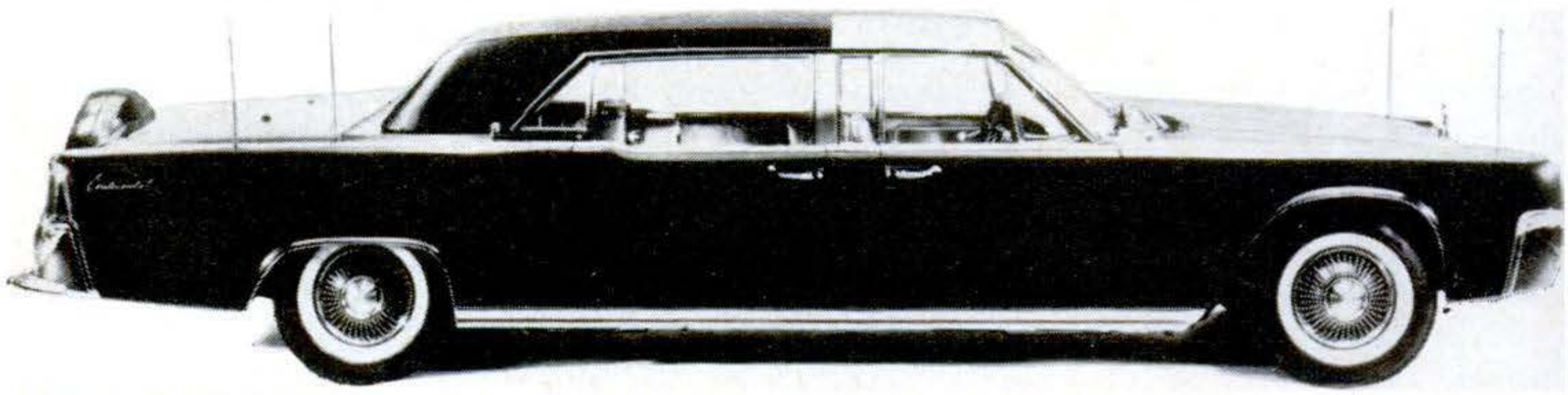
The president also uses a leased Cadillac limousine sedan that is armored.

The Secret Service is extremely sensitive about disclosing details of the President's cars. A Guam newspaper reporter recently learned just how sensitive the President's bodyguards are when Mr. Johnson was on the island last March for the Vietnam summit conference. When the reporter got close to the bubble-top Lincoln and began taking notes, he was quickly pulled away, warned, and his notes confiscated.

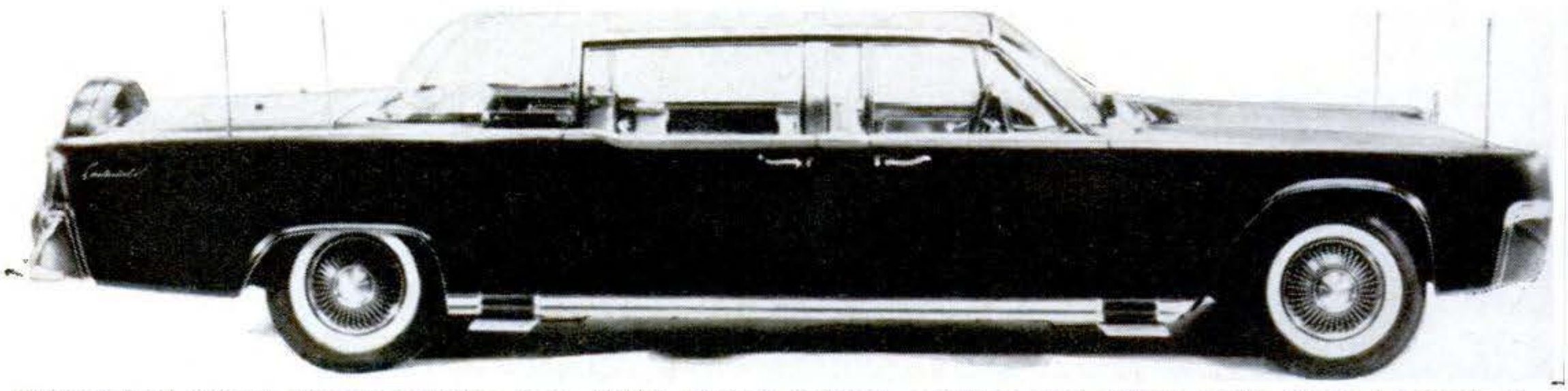
The nondetachable bubble top is not the only change to lessen chances of another Oswald getting at a President. The greatest improvement at the Secret Service is its protective research operation—now a vastly more sophisticated intelligence-gathering and evaluation system employing modern techniques in science, electronics, even psychiatry.

The interest of the Secret Service now goes beyond obvious cranks and mental cases, and extends to political extremists of every stripe—subversives, ultra-rightists, racists, and fascists—whose statements or actions have suggested tendencies toward violence.

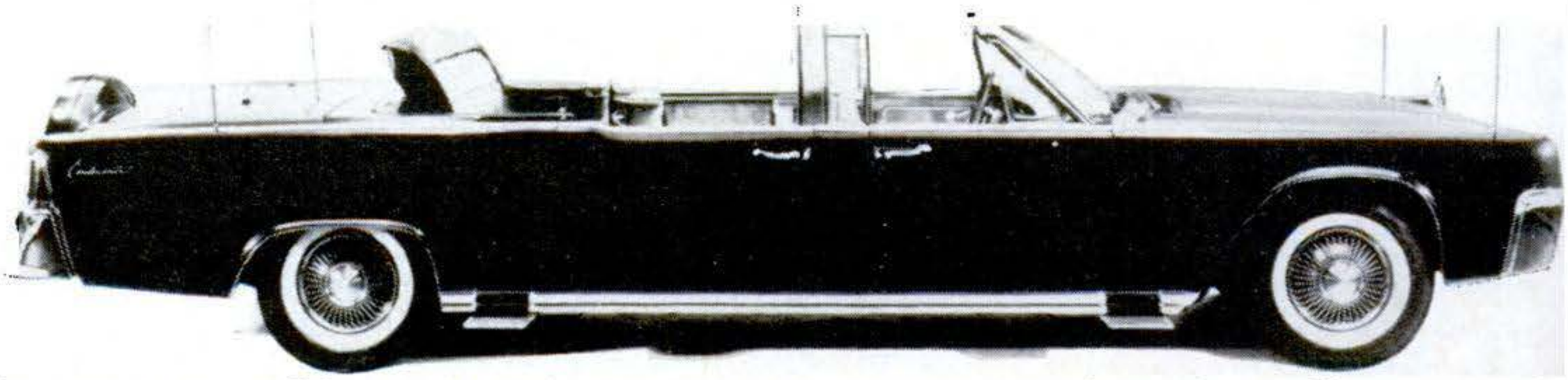
Bulletproofing insures that a tragedy like that at Dallas will not reoccur



Lincoln Continental, rebuilt for President Johnson by Ford, has detachable cover for privacy.



Removing cover shows bubble top. With armor added, engine and other parts were beefed up.



Car was a convertible, but is no longer used this way because of security problems created.

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ards LBJ

Bulletproof screens like this glass shield, set up before the White House for the 1965 inaugural parade, have been used on a number of occasions to protect the President and his party. A similar shield was erected at the U.S. Capitol. Agents try to spot potential troublemakers before a dangerous incident can occur.

As a result of the Warren Report, which was sharply critical of the lack of liaison between the Secret Service and other federal and local agencies, the Service now is receiving far more information from the FBI, CIA, State and Defense Departments on defectors, Communists, and other suspect persons. The monthly flow of items of intelligence on potential troublemakers has grown from just a few hundred a month in 1963 to 6,000 to 7,000.

The Service's "trip file," containing the names of those deemed to be serious threats, and thoroughly checked whenever a presidential trip is planned, has grown from about 100 to about 1,800. It doesn't necessarily mean that more people have become threats. It could reflect a more efficient intelligence method of spotting persons who should have been considered threats all along.

The computer stores this information geographically. Say the President is planning a visit to Akron. In a few moments, the computer can spew out a report on persons in the Akron-Cleveland area who might be of concern to the Secret Service in connection with a presidential visit.

Had the present protective research system been in effect in 1963, Oswald most certainly would have been flushed before President Kennedy ever left Washington for Texas. The Secret Service would have been advised by the FBI of Oswald's presence in Dallas and his employment in a building overlooking the motorcade route.

A dishonorably discharged Marine, Oswald had defected to the Soviet Union, married a Russian girl, and returned to the U.S.; he had spoken for the Fair Play for Cuba Committee; and had gone to the Cuban embassy in Mexico City to seek a visa to Cuba. All of this, and much more, was known to the government; none of it was known to the Secret Service.

One is incredulous in retrospect, as was the Warren Commission, on realizing that while the FBI, CIA, State Department, and Office of Naval Intelligence all had files on Oswald, the Secret Service had nothing—not a solitary word.

While Oswald, under today's rules, would be a marked man—certainly warning bells would sound—what of persons less clearly marked? While no one is foolish enough to offer guarantees, the present system worked, on just a few hours notice, on Feb. 23, 1966, when Mr. Johnson addressed a Freedom House banquet at the Waldorf-Astoria Hotel in New York.

When Mr. Johnson was interrupted by a man who climbed on a chair and shouted, "Peace in Vietnam," the heckler was hustled away by two tablemates. It was no coincidence that the two tablemates were Secret Service agents.

The Service had received the 1,500-name guest list at four that afternoon. A quick check with the New York City police Special Squad brought word that the man was a potential troublemaker.

Tighter coordination with local police is one of the major recommendations of the Warren Commission on Secret Service procedures, recommendations now being carried out. The cooperation of local and state authorities is essential when the President is traveling.

Another major recommendation concerned the checking of buildings along

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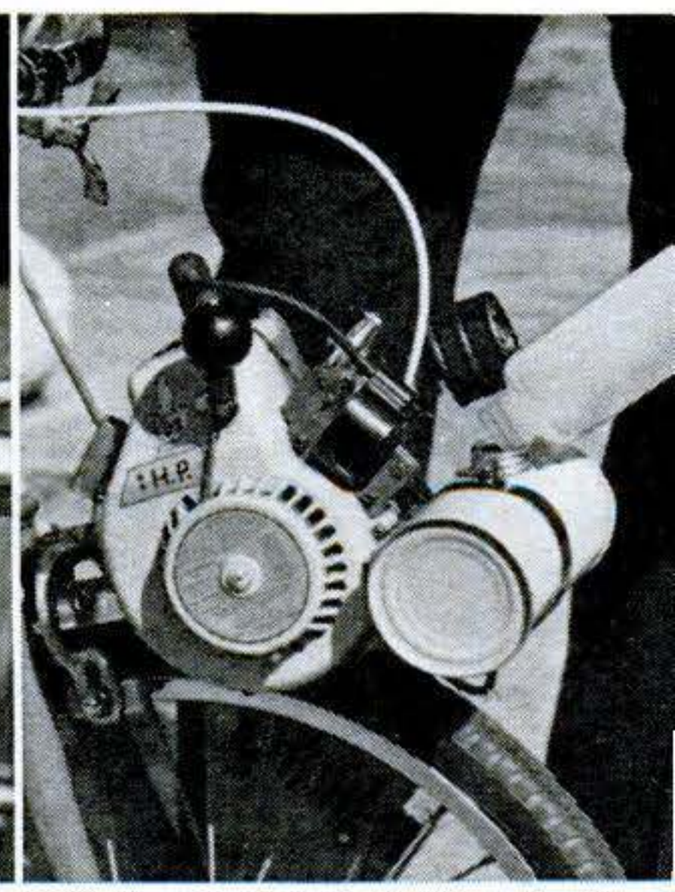
Tin-O-Bike carries easily in its canvas bag. Twenty-gauge steel-tubing frame assembles with butterfly nuts



"Transmission" is a front-wheel friction drive with a five-speed "derailleur" and slip clutch. Brakes are front

Collapsible motorbike weighs exactly 28½ pounds

Jack Fried of Los Angeles is a bald-headed little guy of incredible energy who has designed and is about to produce what may be the world's smallest powered bike. It folds up, too. It can be checked as baggage

Chopper adds a propeller

Latest of the Army's helicopters is this AH-56A from Lockheed. It's a different breed of cat from ordinary rotary-wing machines. A propeller on the tail whizzes it along at 250 m.p.h.—nearly twice as fast as any combat helicopters in service. Small, conventional airplane wings help the rotor's lift. Power comes from a gas turbine.

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-hp. engine is two-cycle.

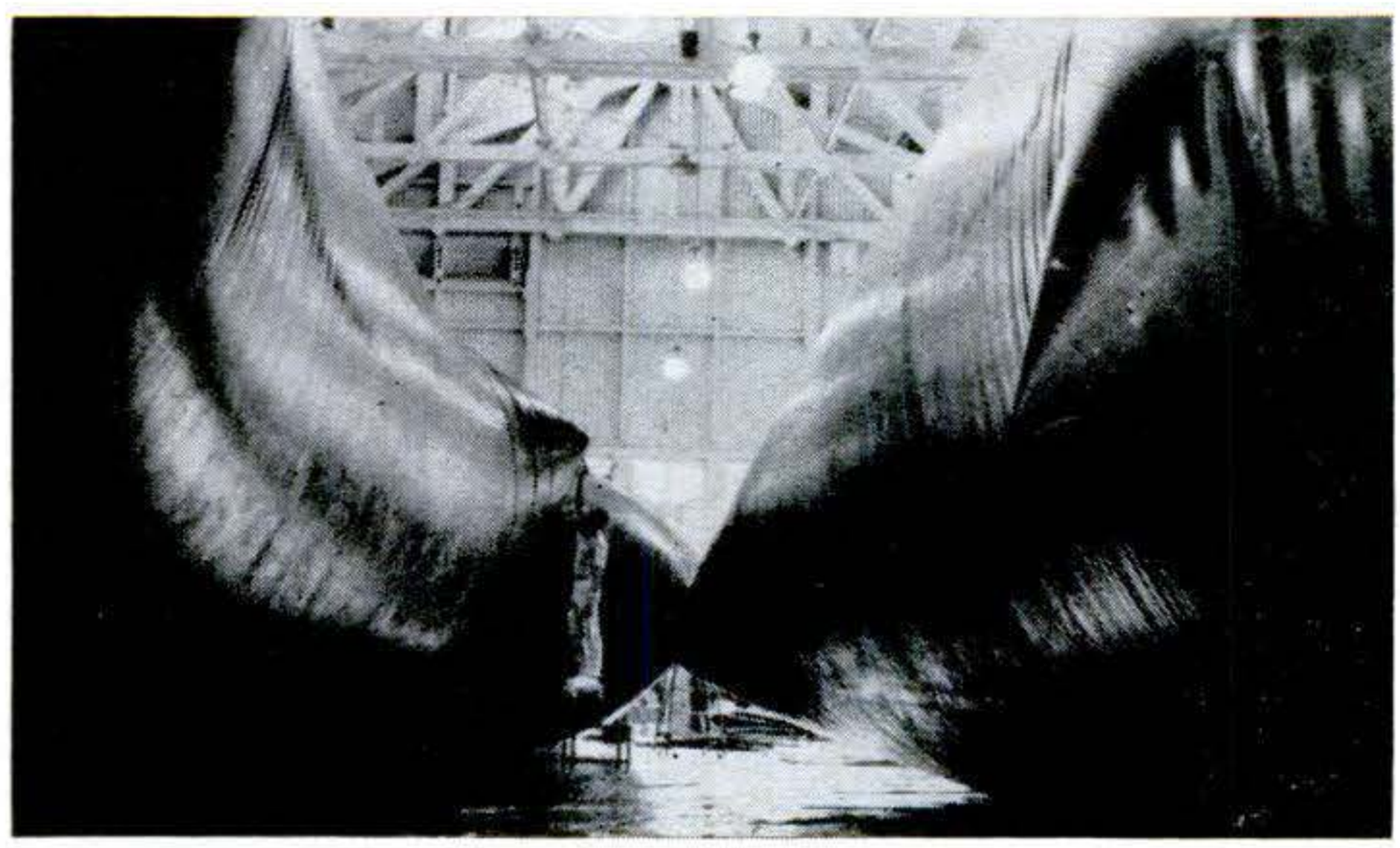
el rim calipers. Throttle is a twist-grip. Sixteen-inch wheels carry tires at 60-pound pressure.

on an airline or stowed in a car trunk. It weighs 28½ pounds—with motor.

Fried calls his steed the Futura Tin-O-Bike. It folds up or is assembled in 10 seconds without tools, goes 25 m.p.h., and gets about 200 miles to a gallon of gas. A machinist and toolmaker, Fried is an executive of the United Inventors and Scientists of America. Forty-four inches long by 24 high, the Tin-O-Bike will retail for about $90.

Pillows, they call them

What looks like the starboard and port sides of a couple of whales actually are a brace of "pillow tanks" that can be used to store 50,000 gallons of fuel or other liquids—each. They're getting finishing touches here at Goodyear's Litchfield Park, Ariz., factory. For movement from one place to another, the pillow tanks are deflated and folded.



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Your Teeth Can Last a

Hate to go to the dentist? New fluoride and phosphate preparations, inoculations against decay, and a hard plastic tooth coating may spell the end of cavities

By LAWRENCE GALTON

Next time you get a cavity in a tooth, you can blame it on yourself—maybe, too, on a dentist who isn't up to date. So-called caries—the rotting away of teeth—is, or should be, old hat, largely outdated.

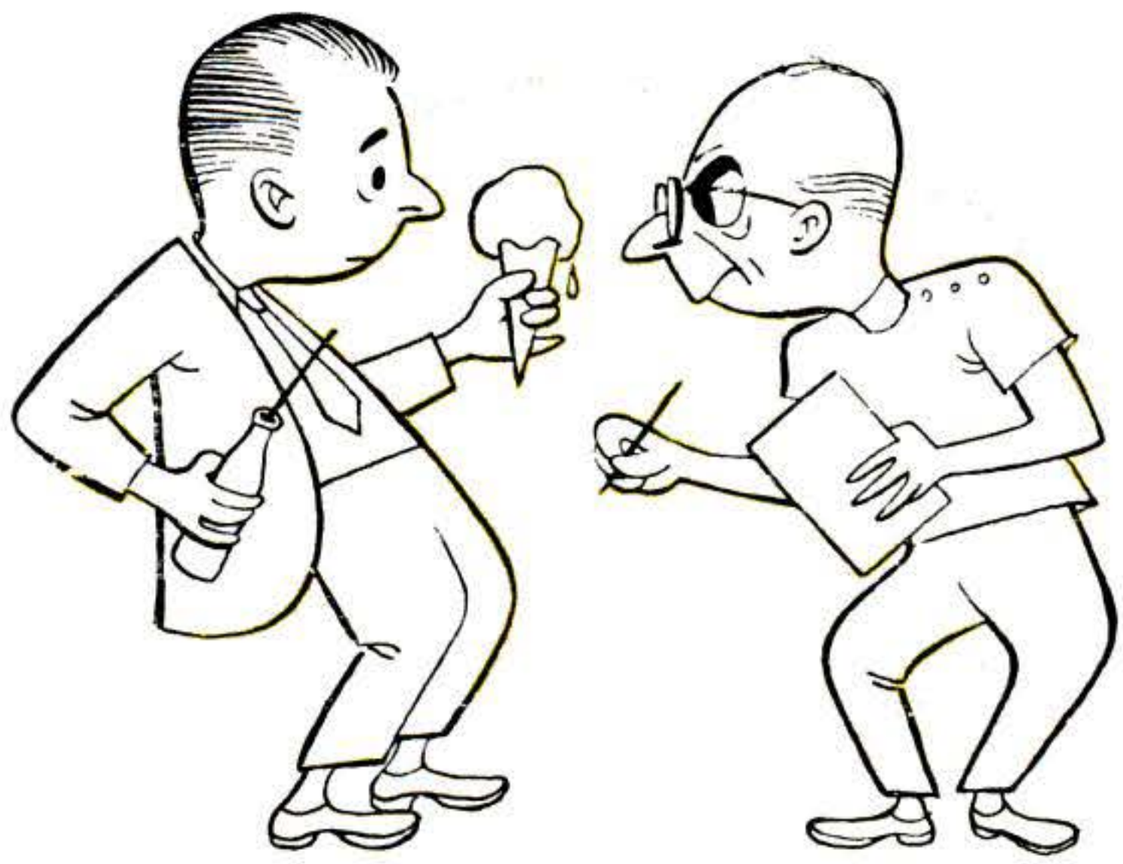
Who says so?

Topnotch dentists—still, relatively, only a handful but now beginning to multiply—who are going all-out for preventive instead of just fix-it dentistry. The big news is that decay almost can be made the exception instead of the rule. And not just in kids; in adults, too.

With a simple program, Annapolis midshipmen now are close to being impervious to decay. Where the average young adult can expect to have two new cavities a year, middies now can expect at most one in 10 years.

What causes decay? Ever use an acid to etch away at a piece of metal? That, in a nutshell, is what goes on in your mouth and sets up decay.

Always in the mouth are bacteria—a considerable variety. The bugs feed on food particles. A result of their feeding is acid production.



Bacteria in your mouth convert food particles to acid, which attacks tooth enamel. Sweets are particularly bad; they turn to acid immediately.

Acid eats away at the tooth enamel. It's the toughest substance in the body, but it's not acid-resistant. Eventually, the acid penetrates. It may make so tiny a hole you'd never suspect it's there. But it can be enough to let acid start working on the softer, bone-like dentin under the enamel, and then on the pulp, the living part of the tooth where nerves and blood vessels are.

Once the decay process reaches the pulp, it goes without saying that you'll have pain and stand a good chance of losing the tooth.

Contrary to what you may have heard, a diseased tooth isn't necessarily a local affair. "Dental diseases are directly responsible," says Dr. Joseph C. Muhler of Indiana University Dental School, "for general poor health, affecting patients of all ages."

Nobody knows how many ailments are triggered, or contributed to, by dental disease. Among those particularly suspect are rheumatic disorders, gastrointestinal and kidney diseases, skin diseases, and bacterial endocarditis (a heart infection).

Recent developments in dentistry are especially welcome, for the American mouth is a disaster area. More than 20 million Americans have lost all their teeth; 90 million have 18 or more missing, decayed, or filled teeth. By age 35, one of every five people needs dentures; by 55, one of every two. Two-thirds of youngsters below age five have decaying teeth; by the teens, five of every six.

Modern dentistry, mechanically advanced and capable of fine fix-it work, had to wait a long time for a clue to any practical means of stopping tooth decay before it could get started.

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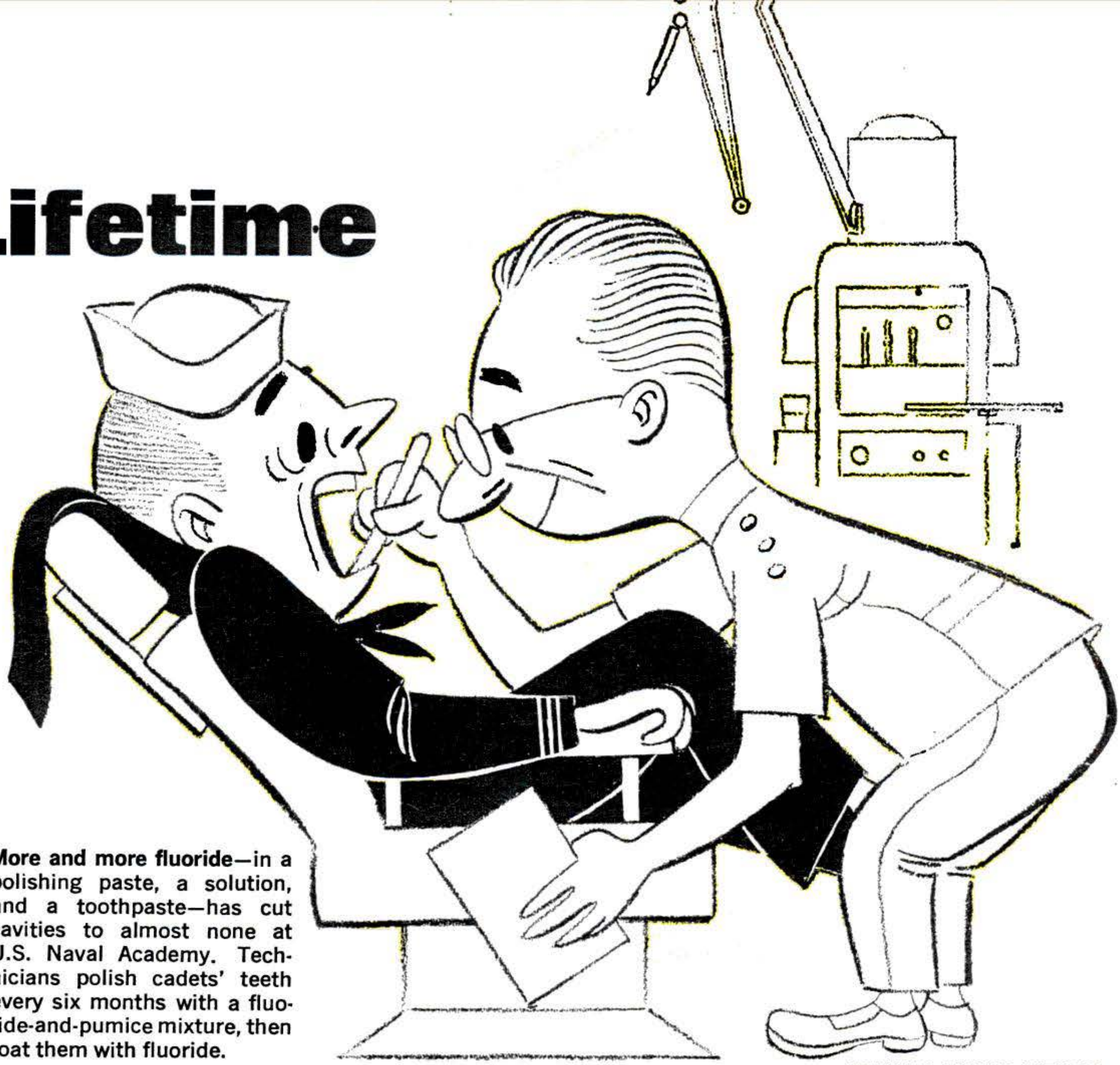
Lifetime



More and more fluoride—in a polishing paste, a solution, and a toothpaste—has cut cavities to almost none at U.S. Naval Academy. Technicians polish cadets' teeth every six months with a fluoride-and-pumice mixture, then coat them with fluoride.

DRAWINGS BY HERB ANTHONY

The fluoride breakthrough. The first clue—although nothing was done about it—was turned up in 1900. An American physician, a Dr. Edgar, serving in Italy as an examiner of immigrants to this country, observed that many coming from an area in Naples had brown-stained but healthy teeth. Twenty years later, a Colorado Springs dentist found the same condition in his patients.

Finally, in 1938, other investigators connected healthy discolored teeth with drinking water containing fluoride.

It turned out that fluoride taken into the body regularly during childhood could do something remarkable. It could be laid down, while teeth were being formed, so it combined with the enamel and made it more acid-resistant, therefore more decay-resistant. In controlled amounts it would not cause discoloration, and cavities would be reduced—at least for children—by 50 to 65 percent.

The next discovery came about 20 years ago: Fluoride could be applied directly to the enamel. If a dentist painted on four coats of a two-percent sodium-fluoride solution once every three years, tooth decay would be reduced 25 to 40 percent—but only in children up to 15. It didn't work for adults.

The search was then on for new compounds that might be better than sodium fluoride. It led to stannous fluoride, a combination of tin and fluoride. One application of stannous fluoride a year proved to be as much as 38 percent more effective than four of sodium fluoride. It turned out, too, that stannous fluoride could work for *adults* as well as children.

Meanwhile, Indiana University investigators were at work on a project to develop a toothpaste that might help combat decay. This was no new idea. A material called chlorophyll had been added to some dentifrices with the idea that chlorophyll not only would improve the

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breath but also reduce bacterial growth. Dentifrices containing ammonia compounds that hopefully cut acid formation had been developed. Dentifrices containing antibiotics had been tried with inconclusive results; they had to be withdrawn when it was found that people became sensitized to the antibiotics, which then could not be used in a medical emergency.

The Indiana investigators finally found a way to incorporate stannous fluoride into a toothpaste so its value wouldn't be lost. Methods had to be found to keep the compound from deteriorating in a tube. Also, toothpastes usually contain abrasive agents to help remove food and other stain from teeth and, because conventional abrasives inactivated stannous fluoride, a new one—calcium pyrophosphate—had to be found.

The rest is history. Approved by the American Dental Association's Council on Dental Therapeutics, stannous fluoride toothpastes swept the country.

Combined, fluoride techniques can reduce decay by as much as 90 percent. But that's only part of the story.

The triple approach. The Armed Forces have a triple approach—it uses stannous fluoride in a polishing paste as well as in a solution and a dentifrice. And it works like this:

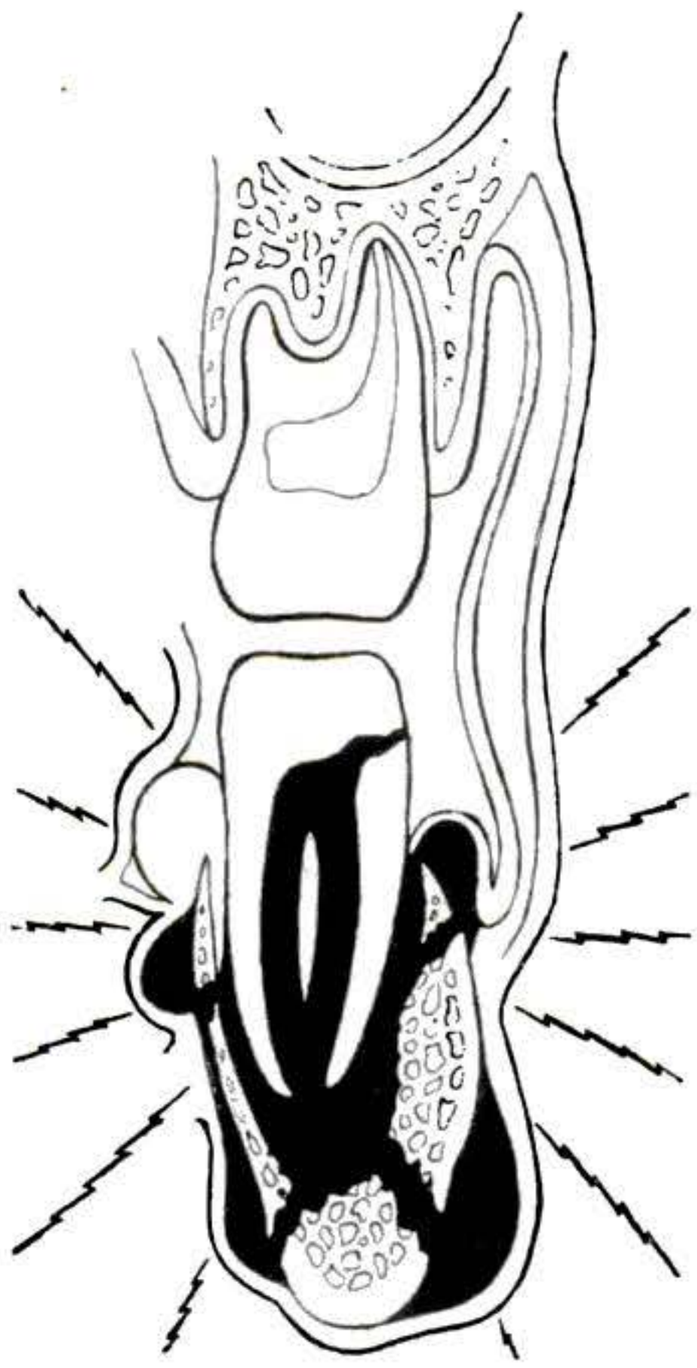
First, teeth are polished with a new pumice mixture that contains 17 percent stannous fluoride. Most civilian dentists have customarily finished up a prophylaxis, or scaling of the teeth, with a polishing for cosmetic purposes. The pumice mixture also makes for a "nice smile" but it goes a step beyond that: It burnishes fluoride into the tooth enamel.

Immediately afterward, a 10-percent stannous-fluoride solution is painted on the teeth—a 15-second procedure.

The first two steps start the serviceman off—and the third step is simply the daily use of a fluoridated toothpaste.

Says Admiral Frank M. Kyes, chief of the Navy's dental division: "Use of these fluoride applications has virtually stopped decay at the U.S. Naval Academy." And elsewhere in the Navy, too—at the New London, Conn., base, for example—the triple fluoride method has cut decay by 86 percent.

More to be done. In effect, fluoride treatments armor-plate the teeth. Still, they fall short of 100-percent protection. But there are other weapons on the way.



Tooth decay can have far-reaching effects. If decay progresses far enough (as in lower molar shown), gums become swollen and tender, inflammation spreads. Finally, bone supporting the teeth is destroyed; the teeth fall out.

Among the vast quantities of bacteria in the mouth are some—the big troublemakers—that form sticky deposits on tooth surfaces. The deposits are called plaque and are invisible. It usually takes several days for a thick clump of the germs to get a hold on a tooth surface. And they usually latch on in sheltered areas between the teeth, near the gum line, and in crevices and grooves on the teeth.

Decay is most likely to occur under plaque. The plaque keeps out the saliva which could help neutralize acids produced by the bacteria. In effect, the plaque shelters the bugs and they can do their work undisturbed.

Moreover, it's plaque that can lead to formation of tartar, a hard deposit which, once formed, can't be removed by brushing, only by a dentist or hygienist using special instruments.

And it's tartar that sets the stage for periodontal, or gum, diseases which, after 35, are the most common causes of loss of teeth.

Tartar formation can now be prevented with effective new methods of home care. Learning how to brush your teeth effectively can be remarkably simple if you use a *disclosing wafer*. It's a tablet containing a harmless food color, usually bright red, that stains only clumps of

[*Continued on page 180*]

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Fluorescent crosswalks help pedestrians watch their step

Tiny glass beads embedded in some British crosswalks give a pedestrian a break in traffic at night. The material reflects low-angle beams from headlights. Made of optical-quality glass, they do the job even when wet and are not darkened by exhaust fumes. The beads are mixed with bauxite chips to provide a nonskid surface.

Just drop a card to dial

There's no end to the tricks they do with telephones these days. Now Bell has come up with a card dialer. Just drop a coded plastic card into a slot on this telephone and press a start bar. The phone does the rest. Cards can be coded with a pencil. The instrument itself has a compartment for filing 40 cards. Just dandy for nonstop talkers.

Hovercraft with a duct

The thing sticking out in front of this personal hovercraft is an air duct, and the Power Breeze Co. of Panorama City, Calif., says that it gives its machine more scat on cross-country trips. In speed ranges up to 45 m.p.h., the duct captures additional air to increase flow to the propellers driven by two six-hp. engines. Lift: 250 pounds.

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The Lively '68 Snowmobiles

Snowmobilers get the jump on winter with stunts like this. Bombardier Super-Olympique has the rugged construction needed to withstand this kind of high jinks—but the driver isn't guaranteed.

New Skeeter is just the thing to open new vistas to winter outdoor enthusiasts. Evinrude has hitched it to an improved 16-hp. two-cycle engine. The engine has been quieted down with a dual muffler system and a baffle; a compression release makes starting easier. The Skeeter also has a new hinged hood (below). It flips up to make access easy for servicing the engine and spark plugs. Speed: 40 m.p.h.

Heat Up the Winter Scene

• More power • More models • More options
• More dependable performance • More fun

By HERBERT SHULDINER

Growing faster than drifts in a blizzard, snowmobiling is becoming one of our most popular winter sports. And this year's parade of new snowmobiles is bound to lure even more hibernating outdoorsmen out of their snug dens. That's because they are the most powerful rigs ever. There are even Wankel engines on some, for the first time. Also, you have more models and options to choose from—something to satisfy almost every taste and purse.

The performance of snowmobiles is more dependable, too. A sign of the technical excellence the machines have attained is found in the fact that at least two companies, Bombardier and Polaris, have covered their snowmobiles with the industry's first full one-year guarantee.

Engines are the top news in this winter's snowmobile horsepower derby. You can choose from literally dozens of engines to find the one you want, whether it's hot or sedate.

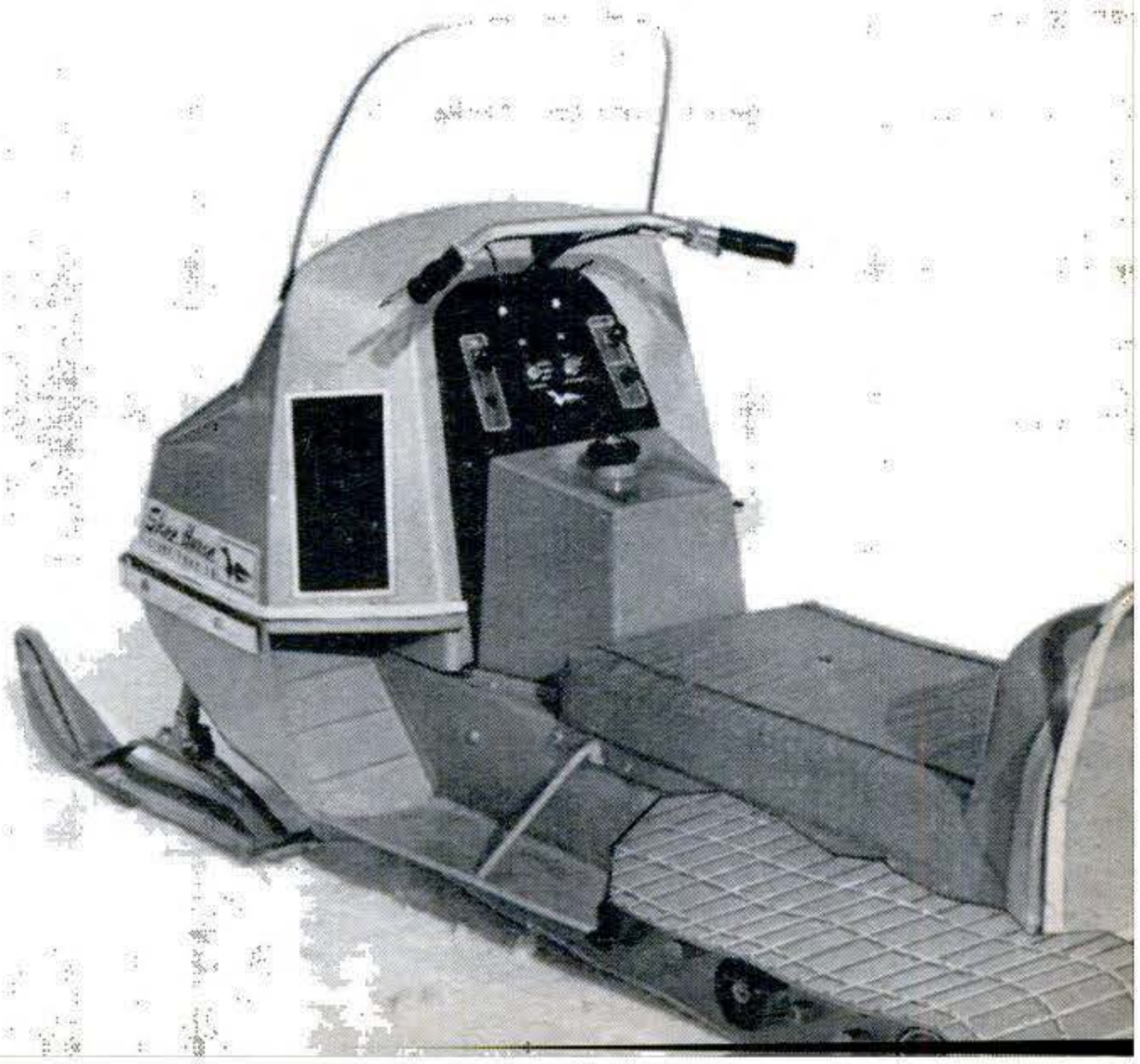
Rotary combustion in snow country. What promises to be one of the biggest engineering breakthroughs in snowmobile power is the new Wankel engine you can now get on some Polaris and Scorpion models. It's a Fitchel Sachs 300cc. RC engine that puts out 18 horsepower. While it's far from the most powerful snowmobile power plant, it's a pretty big engine for ski scooters. It's easier to start because you're not pulling against compression. And it has a far more pleasing sound than the two-cycle screamers on most snowmobiles.

The Trail-A-Sled Scorpion offers the Wankel as an option on both its 15- and 18-inch-track models. The standard-track will cost you $1,250; the wide-track ups that $100 more.

Polaris is equipping a limited number of its Mustang and deluxe Colt models with the Fitchel Sachs Wankel. But

Continued

Skee Horse from the Johnson stable has a new autotype wood dashboard with convenient access to controls. Storage space has been greatly increased by locating a big bin under the seat. The track (seen in cutaway at right, below) is self-cleaning to reduce clogging of bogie wheels. A chrome tail bumper folds down to become a stand, raising the track off the snow when you want to run up the engine.



A new breed of snowmobile is overpowering Old Man Winter and

Polaris Colt has been completely redesigned, adding quick-release hood latches, improved seats, and more storage space. The Colt also has easier handling, thanks to improved steering system and skis.

AMF's Ski-Daddler is equipped with new caliper-type disk brakes and automatic variable-speed transmission. An easy-to-remove panel on top of the hood gives you quick access to the engine for servicing.

there are also 15 other engine options, ranging up to 744cc., for its stable of snow steeds.

Bombardier has also stepped up the power in its six models, four of which have been cut in price. The new lightweight Olympique with a 250cc., 10.5-hp. Rotax engine is now down to $695.

A new decompressor on Bombardiers halves the effort of manual starting. Brakes have been improved to give 25 percent more stopping power, Bombardier says, and hoods have been redesigned for easier access to the engine.

A no-clog track. The dependable Johnson Skee-Horse bows in with a new engine that turns out 16 horsepower, two more than last year's models. The more powerful Johnsons also have a new self-cleaning track that stops snow accumulation and bothersome clogging inside the track.

The Johnson line—Light Trac 15 ($985); Wide Trac 20 manual start ($1,125); and the Wide Trac 20 electric start ($1,255)—have a stylish auto-type wood dashboard that gives you easy access to all controls. The Johnsons also have a hinged hood that opens for convenient access to the engine. All the Wide

Larson Eagle is a rugged vehicle that's ideal for family fun, or for riding in mountainous terrain. The 18-inch-wide track, supported by a dozen bogie wheels, provides superior traction and flotation.

Yukon King Grizzly adds several engineering improvements for '68—a longer, 124-inch track, supported by 15 bogie wheels, and a Sense-o-Matic transmission with built-in automatic torque sensing.

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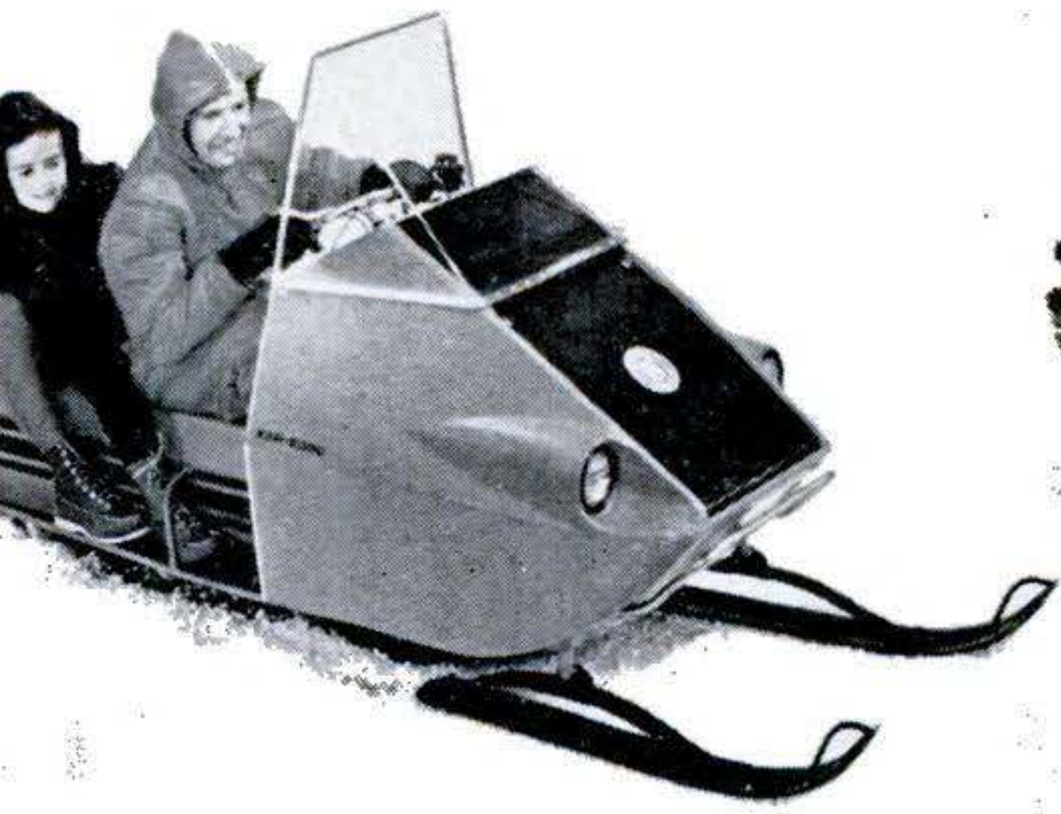
giving sportsmen a chance to enjoy outdoor living all year long



Wide-track Wildcat, this XSR 2000 model is one of Sears' two new snowmobiles. It has an electric-start engine that can hit 40 m.p.h., sports twin head and tail lamps, and is painted red and black.

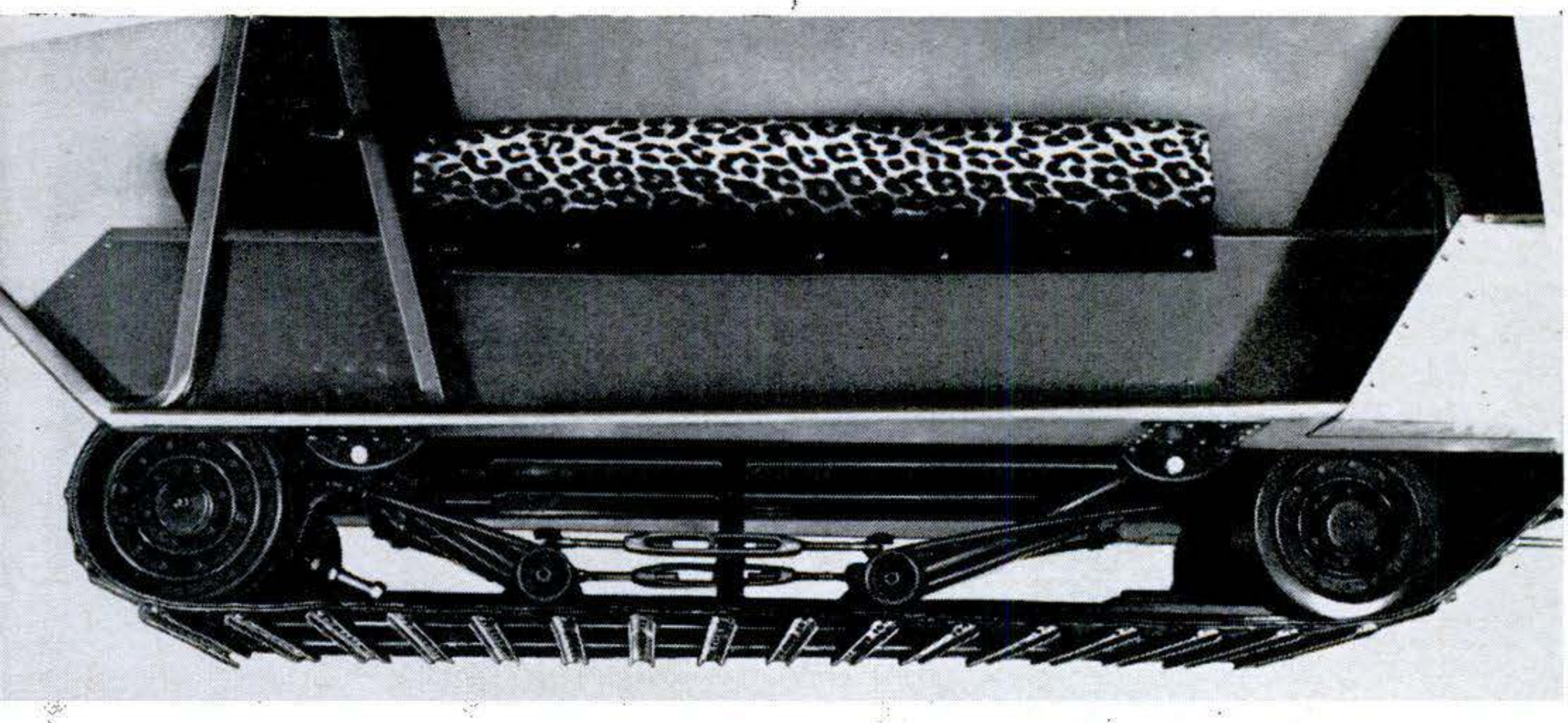
Trade Winds Tiger is an economy job with lots of de-luxe features. It comes with an 11½- or 15-hp. engine and has a removable four-gallon gas tank. The Tiger has a tip-up hood and kick stand for runups.

Trac models have reverse transmission as standard equipment this season.

Evinrude's three new Skeeters have been slimmed down substantially. The standard 15.5-inch-track model has had its weight reduced 60 pounds and with its more powerful 16-hp. power plant can now hit a top speed of 40 m.p.h. On the

[Continued on page 200]

Arctic Cat Cougar (right) is a new economy compact. Its track is supported by a standard bogie-wheel suspension. The Arctic Cat Panther series has a unique torsion-spring suspension system (below) said to reduce bottoming and allow you to adjust for load.



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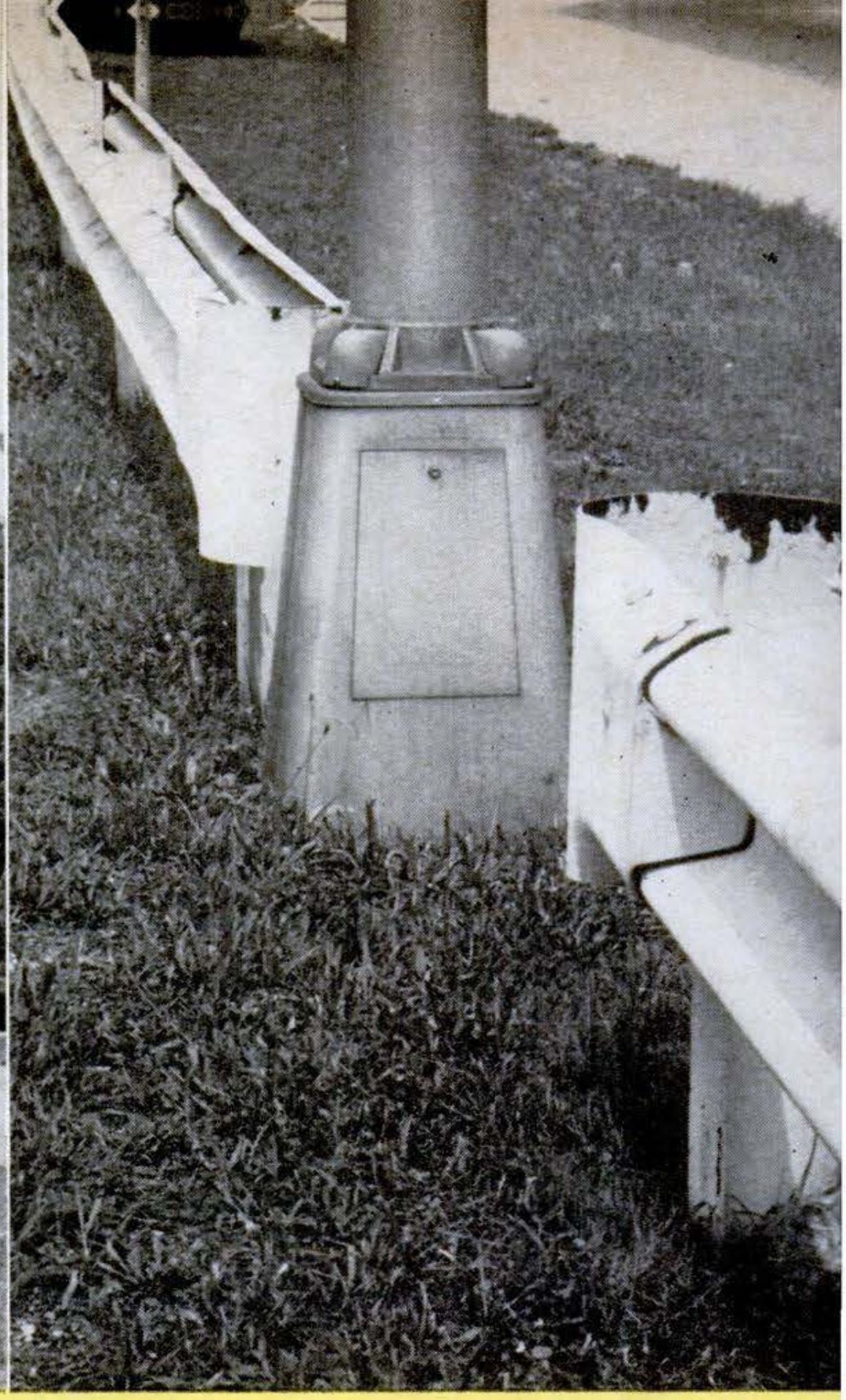
Just inches from traffic on this shoulderless high-speed expressway stands a stoutly supported sign. Common practice on newer roads is to use large **steel I beams imbedded in concrete—a death threat to any vehicle colliding with them. Answer? Locate signs farther from the road on supports designed to break away when a car collides with them.**



How to create a hazard: A car striking and sliding along this guardrail would be guided into a collision with the lamp post. Other poorly placed guardrails **lead into the sides of such obstacles as bridge parapets or overpass abutments like that at right. Solution: Locate the lamp post inside guardrails and gently curve rails around it on either side.**

PS EXCLUSIVE!

The Man-Made Highway

Congressman Blatnik, Dem., Minn., chairs Public Works Subcommittee.

Can you spot the roadside deathtraps that kill 20,000 motorists every year and cripple thousands more? In this article a Congressman reveals the shocking facts about our highways—both new and old—and tells what we must do

By REPRESENTATIVE JOHN A. BLATNIK

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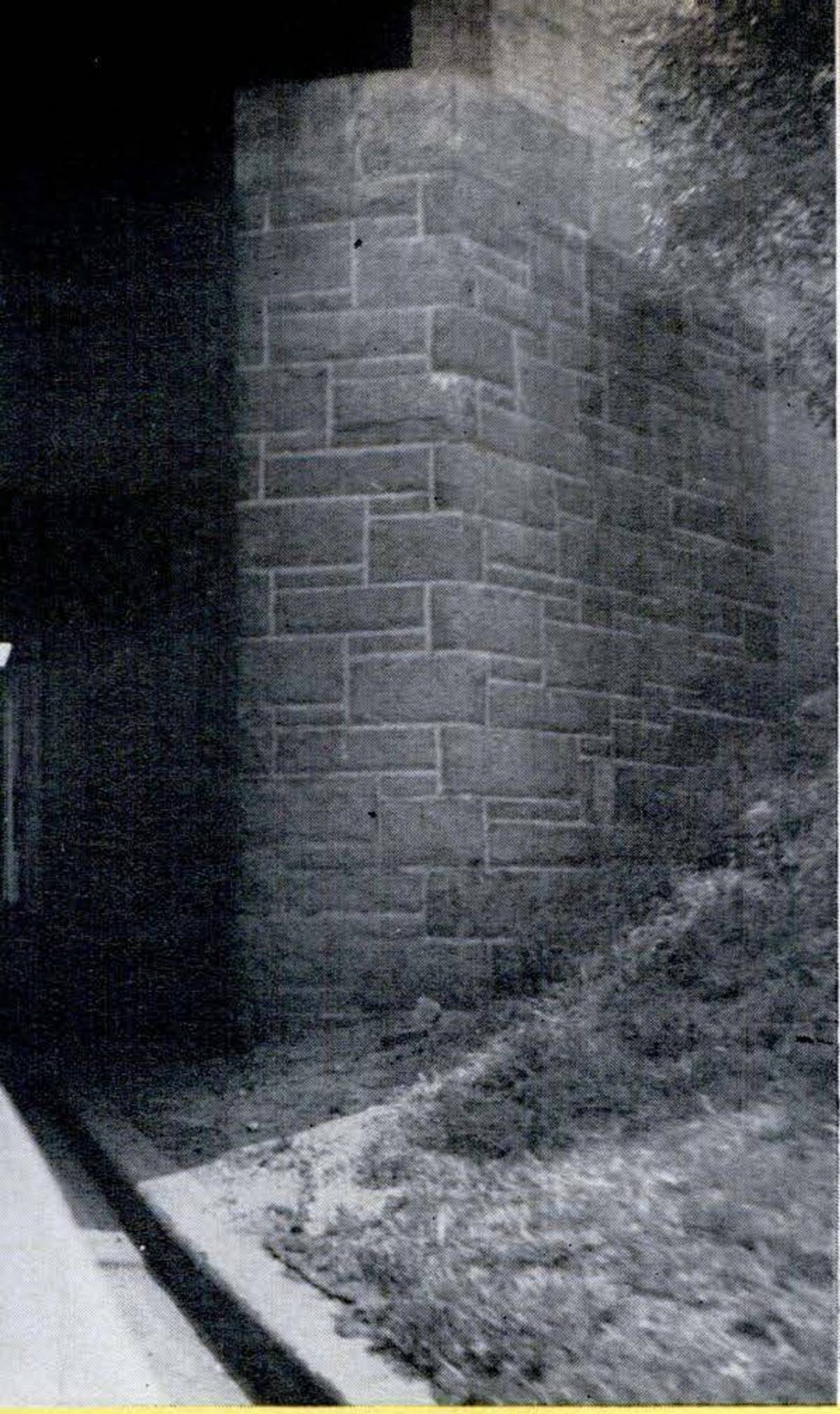

Unprotected bridge abutment, unmarked, not illuminated, and perilously close to traffic is the type of **hazard that causes 61 percent of all highway deaths. Abutments should be farther from traffic, motorists protected by guardrails. In new overpass designs, longer spans with supports in the center median strip end need for supporting walls near the road.**

Expressway exits—"gore areas"—cause 400 percent more accidents than other road sections. Some, like **this, are studded with obstacles: huge sign stanchions, concrete pillars, guardrails, and curbs. At these areas, also called indecision points since the driver must decide which way to go, all obstacles should be removed and a breakaway sign installed.**

Hazards That Kill

During the past few years, we have witnessed the greatest crusade in history for automotive safety. Yet, with all our concern for improving the cars we drive, we have lost sight of one monstrous fact: Every year, built-in deathtraps along our highways kill about 20,000 persons and cripple thousands more in single-car accidents.

These accidents—an enormous two-thirds of the total—involve just one car and one driver in off-the-road collisions.

Shockingly, many of these catastrophes occur on our newest, most up-to-date interstate expressways. Why? Because we find the same mistakes—now more critical than ever—being made on modern high-speed expressways that were made on the roads of 50 years ago.

Because lightly constructed signs located close to traffic on heavily traveled throughways are invariably knocked down when hit, we have resorted to heavy concrete pillars buried many feet in the ground supporting heavy round or I-

Continued

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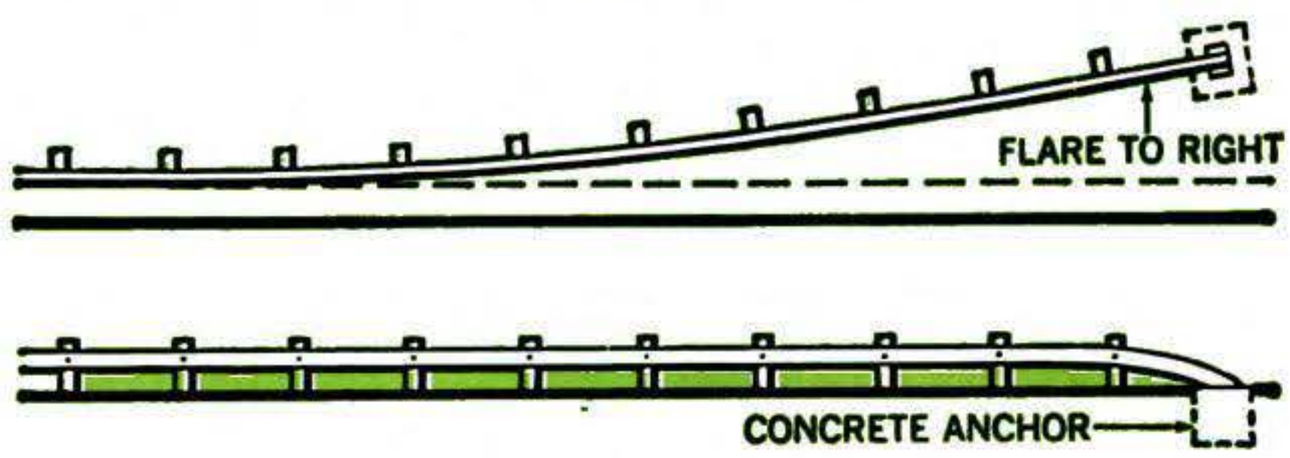
This revolutionary "kicking" sign cuts car damage, saves lives

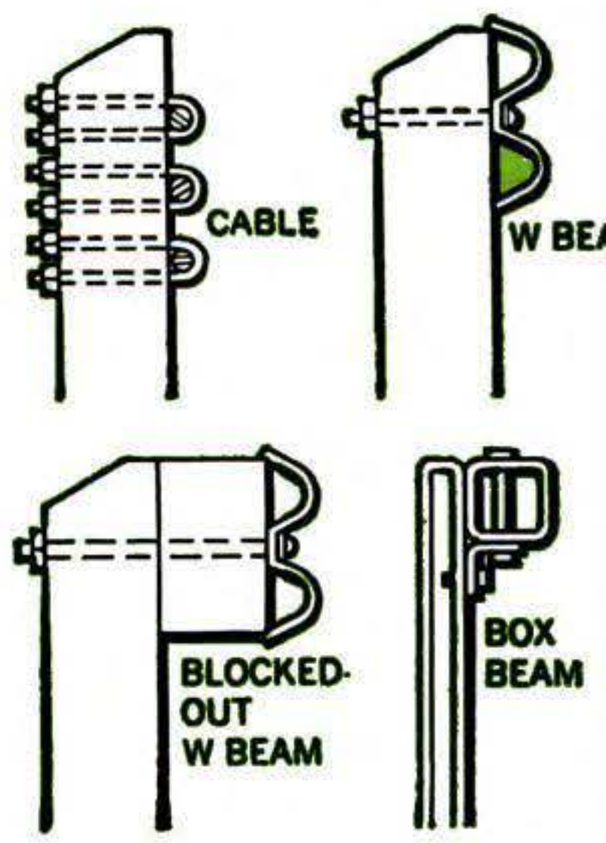
"Kicking" sign has slip joint at ground level that parts on impact. It was developed by Texas State Highway Department, built by Aztec Mfg. Co.

As car passes under, a "fuse" plate (see right) allows sign leg to swing up, minimizing damage to the car and its occupants. Sign is easily repaired.

Guardrail design and installation is changing

Cable and W-beam guardrails snag car wheels on posts or fail on impact. A stronger, nonsnag design is the blocked-out W beam with post spacing reduced from 12 feet, 6 inches, to 6 feet, 3 inches. New box-beam rail (known as weak-post design) may be best, since it bends over and gently redirects car. Ends of rails are themselves a hazard. New technique is to flare them to right, anchor ends in the ground.





shaped steel beams from four to 12 inches thick.

The result? One tragedy after another as cars collide with these immovable roadside hazards.

Guardrails that don't. Another major problem on our roads is unnecessary and improperly installed guardrails. Often, they compound the hazards of driving rather than alleviating them.

In testimony before the House Public Works Subcommittee, of which I am chairman, witnesses displayed one bad example of this kind after another. Among them:

Improperly terminated guardrails that lead to, and end, just before an obstruction such as a bridge abutment. Cars striking the rails tend to slide for a distance, colliding head-on with the concrete support of an overhead bridge or the concrete railing of a bridge over which the car must pass.

Guardrails that begin abruptly, creating a blunt end for drivers to strike.

Guardrails at intersections erected simply to mark off an exit or to protect a sign. They do so, but *kill* drivers.

In one classic example brought to the subcommittee's attention by Joseph Linko, the crusading Bronx TV repairman who, acting as a private citizen, has done much to bring highway hazards to the attention of both Congress and the public, V-shaped guardrails were installed at every exit ramp on a heavily traveled

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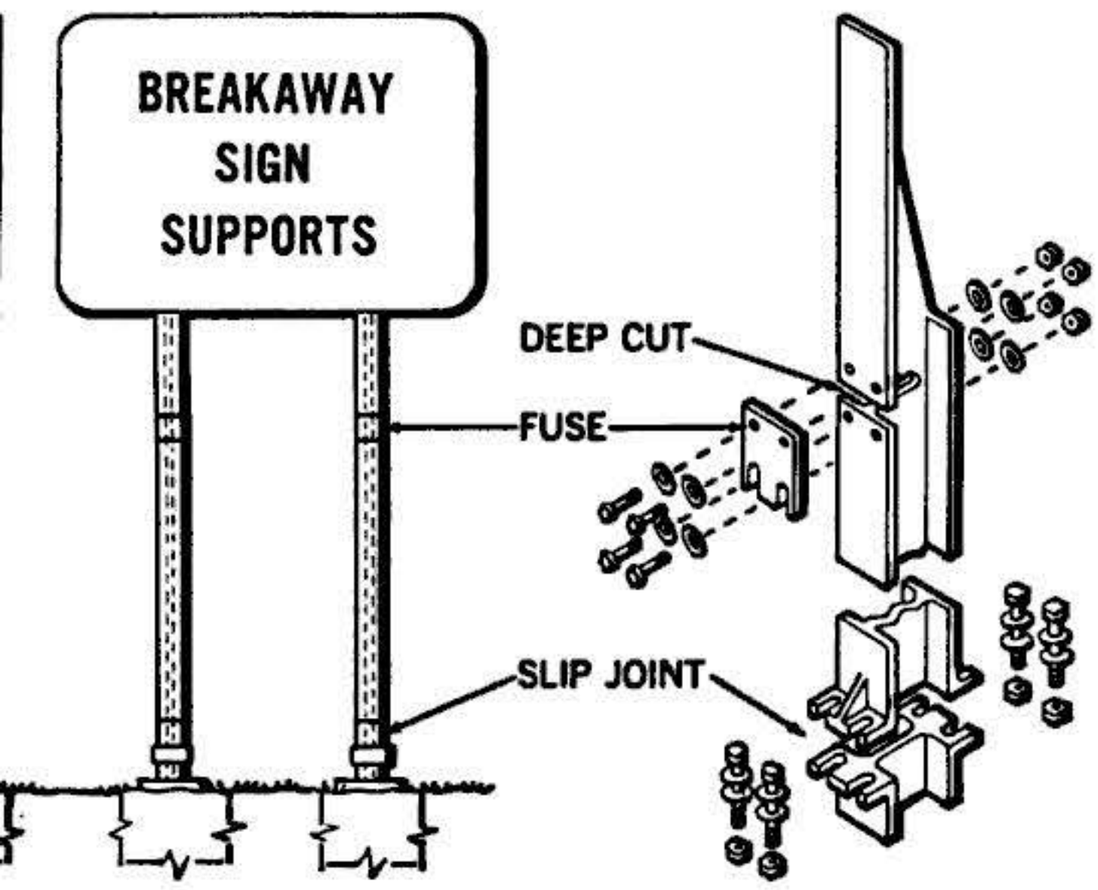
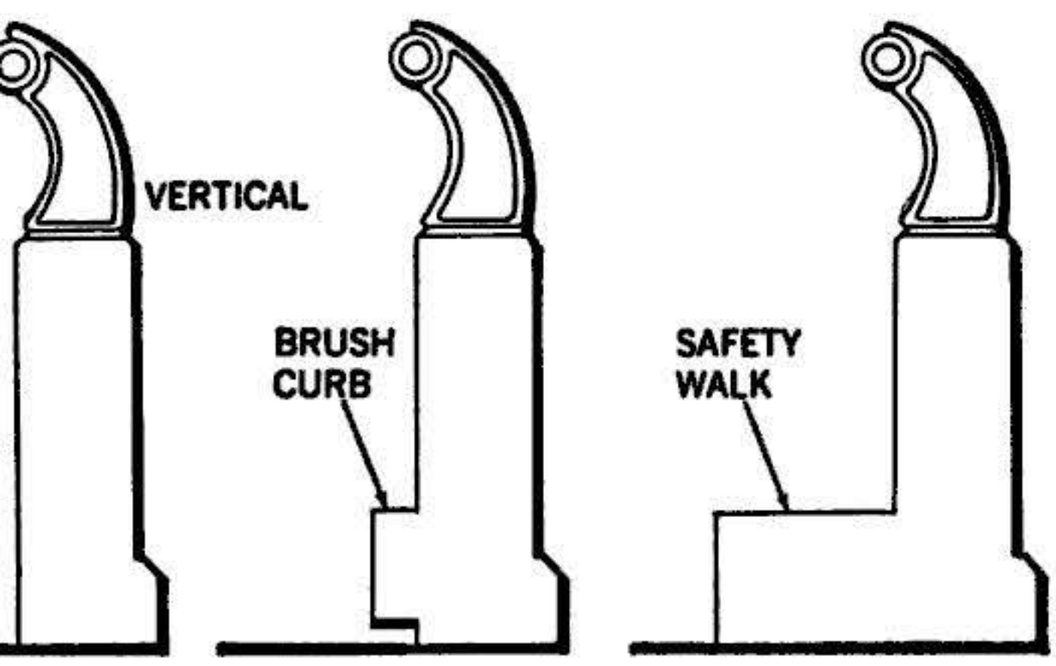
d is easy to repair



olts in slotted base plates slip apart when sign is t. The "fuse," higher up, covers a cut in the sup-ort post and lets it swing up on impact.



Safety walks along bridge parapets have been known to literally bounce colliding cars over railing. Curbs can also be a hazard. Best designs may be vertical or concavely shaped parapets.

expressway in a city on the East Coast.

The guardrails, which form a huge steel arrowhead aimed squarely at oncoming traffic, have impaled both cars and drivers under impact of a collision.

Other guardrails are completely unnecessary, "protecting" light poles or other objects specifically designed to safely break away under impact, or marking the edge of the road with nothing but level fields beyond.

Gore areas. Highway engineers have a term for the triangular areas at expressway entrance and exit ramps: "gore areas." When you consider that these areas have up to 400 percent more accidents than other road sections, the term seems singularly appropriate.

At worst, these "indecision points"—where the driver must decide whether to leave the expressway or continue on—are studded with steel and concrete obstacles that would make a battlefield tank trap seem puny by comparison.

In addition to the usual heavily supported signs—sometimes two or three—certain gore areas sport large wooden barriers supported by concrete posts, guardrails, tall curbs, light poles, and supports for an adjoining structure.

Misplaced and misleading signs often tend to make these indecision points even more bloody. Although engineering standards for sign placement have long been specified, many are too close to the exit point—making it necessary for a driver to cut across traffic—or too confusing to be easily understood.

Other obstacles that kill. Sign stanchions are often constructed across a highway with their supports mounted in concrete on either side of the road, just inches from traffic. Surprisingly, some of the stanchions are not even necessary: Their signs could be mounted on a nearby overpass, eliminating a potential hazard and saving taxpayers as much as $40,000 apiece.

In a number of instances, safety has been subordinated to scenic beauty. Trees planted along a roadway may add visual enjoyment, but in a very few years they become large enough to cause accidents.

As with sign supports, solidly mounted light poles create a serious, ever-present hazard. With the breakaway poles now available, their continued use creates an inexcusable problem.

Bridges, overpasses, retaining walls, and curbs create special hazards on high-speed roads. Many overpasses, for example, expose a blank concrete wall to oncoming traffic—with deadly results. Their center supports, falling within the median area, often take the form of posts or pillars close to traffic, each of which is a deadly obstacle to a car traveling off the road.

Bridges may be narrower than the highway, lack shoulders, or incorporate curbs or safety walks. Statistics show that these designs cause accidents. Narrow bridges cause collisions, while curbs and safety walks, in a number of spectac-

Continued

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Heavy roadside obstacles demolish cars and kill drivers

Foundation for a skyscraper? No—a sign support on Long Island Expressway. Two mammoth 16-inch steel I beams set in concrete pillars three feet above ground and two feet in diameter hold small sign.

ular, tragic accidents, have bounced cars over bridge parapets.

Highway-design factors. What about the overall environment we create for the driver? In a recent survey conducted by the Bureau of Public Roads and the states served by U.S. Route 66, steeply sloped ditches and banks on either side of the road were responsible for better than 25 percent of all single-car accidents. Such slopes usually cause a vehicle to roll over before the driver has a chance to recover.

Narrow median strips, while unavoidable in some metropolitan areas, are another major cause of concern. If the median does not permit a driver to recover after leaving the road, he may enter the opposite lane and cause a deadly head-on collision.

What is the answer? As I have tried to indicate, the findings of the House Public Works Subcommittee have been both explicit and shocking. Frankly, they are incredible. Despite an available store of knowledge from research and experience, even our new roads have continued to incorporate into their design and construction deficiencies from the past.

We can safely predict that each year thousands of vehicles undoubtedly will continue to hurtle off our highways out of control, as they have done each year in the past. Reasons will range all the way from bee stings, sideswipes, or blowouts to driver error or fatigue.

Whatever the reason, however, we as drivers are entitled to a "second chance" to recover control without being smashed against some massive concrete or steel object which, in too many cases, should not have been there at all.

Needed: a safety program. To correct these faults, it is important that we launch, without delay, a program of safety in highway construction. There is much work to be done.

1. All signs should be installed on breakaway supports or located as far off the shoulder as possible within the limits of good visibility. Where heavy, rigid sign supports must be used, the motorist should be protected from colliding with them by guardrails. Unnecessary signs and sign stanchions should be eliminated.

In this connection, it is interesting to note the latest developments in breakaway signs illustrated in this article.

2. Guardrails should be carefully engineered with the end facing oncoming traffic either buried in the ground or flared off to the right. (In a large number of accidents, these exposed ends have penetrated the passenger compartment of colliding vehicles.)

Rails should be mounted flush with the surfaces of abutments and bridge rails, and should be tightly and securely anchored to them. Short sections of guardrails should be avoided, as should unnecessary rails. Often, they serve only to warn motorists of a pole or obstruction —and create an even greater hazard.

What types of guardrail are best? While research is still being done on this subject, it would appear that certain types are superior (see illustrations).

Other new types of guardrails and median barriers are constantly being developed and tested. They range all the way from rosebushes, which are surprisingly good when full grown for stopping runaway vehicles, to new aluminum guard-

[Continued on page 206]

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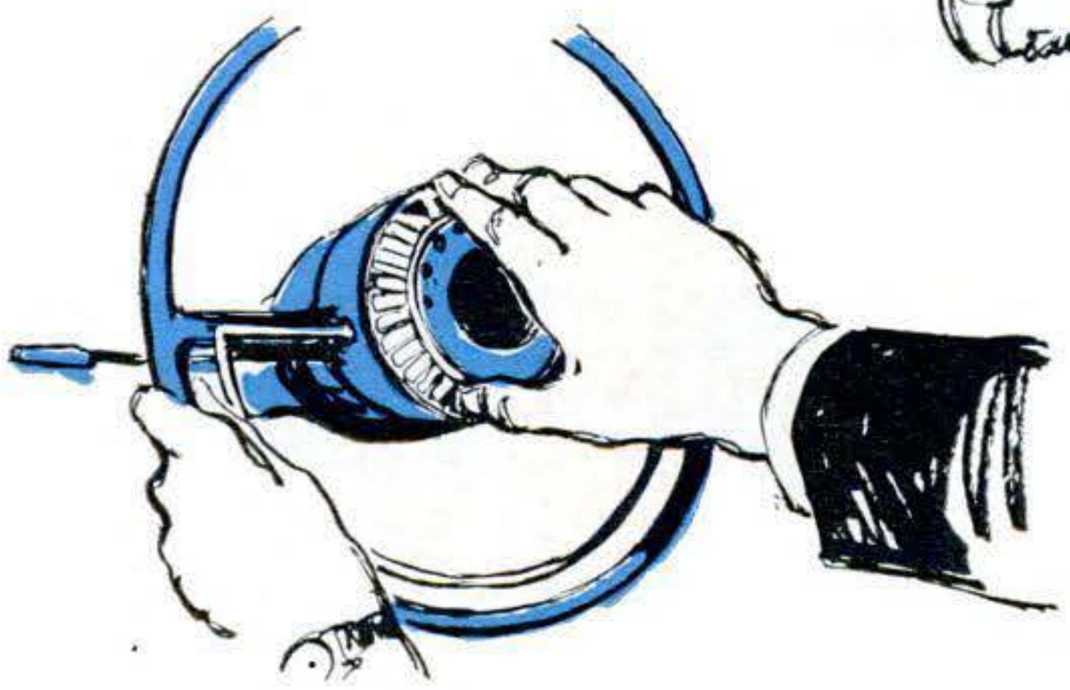
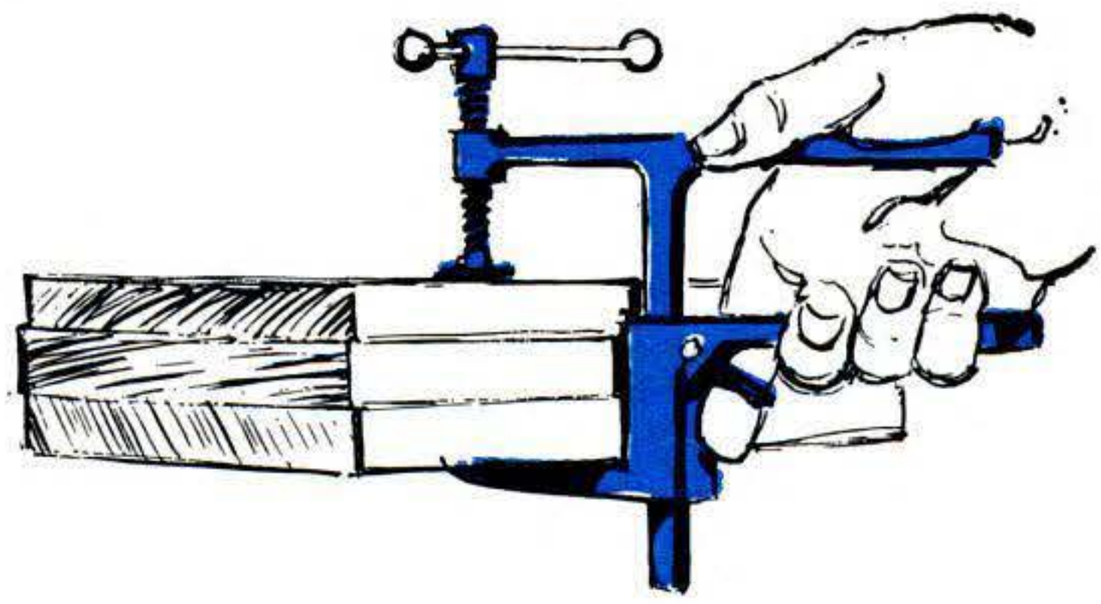
"I'd like to see them make..."

DRAWINGS BY DANA RASMUSSEN

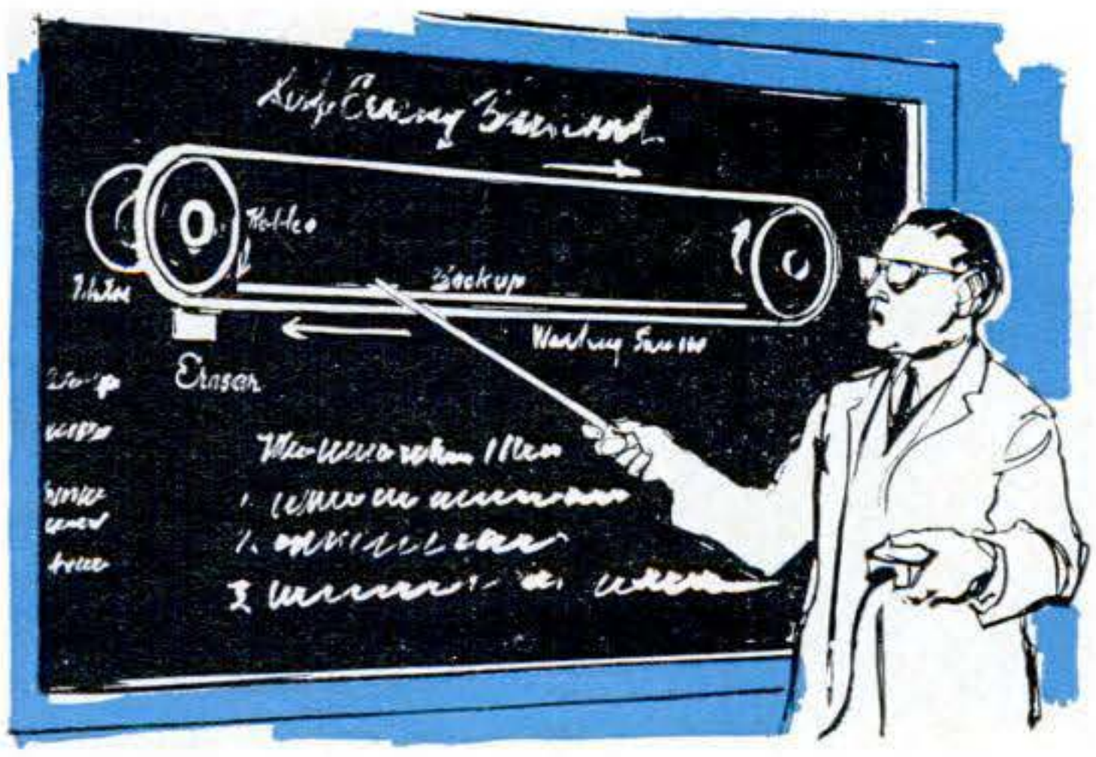
Inflatable floors in tents (or, in big tents, sections of flooring). No more carting of cots or air mattresses—just pump up your bed at night.—*Julia Klang, Kansas City, Mo.*



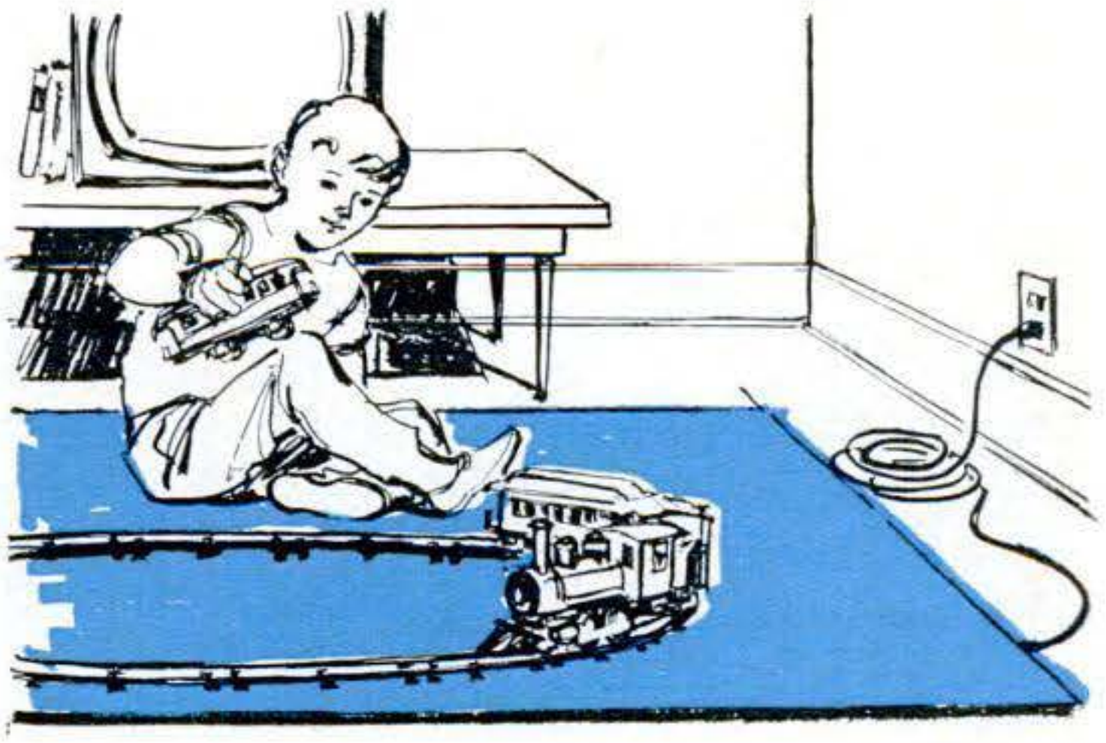
Dial-controlled power steering on cars. By turning the dial, you could increase or decrease wheel tension to suit your preference. —*Brian O'Connell, Arleta, Calif.*



Split C clamps equipped with handles and sliding jaws that would lock. Then parts could be clamped down and held with one hand.—*Henry Siekkinen, Watersmeet, Mich.*



A self-erasing blackboard—a flexible loop. Press a switch, and it would wind beyond its rigid backup board to pass an eraser at one end.—*T. Burden Jr., Portsmouth, Va.*



Electrically wired rugs for use on cold floors. Two-foot-square add-on mats to plug into the basic heated rug would let you cover any area.—*J.T. Ippoliti, Scotia, N.Y.*

Everyone has his own pet idea of a gadget that he would like to see in general use. What's yours? We will pay $5 for each one published. Please use Government postcards only. Send to ILTS Editor, Popular Science, 355 Lexington Ave., NYC 10017. Write your name and address clearly. Contributions cannot be acknowledged or returned.

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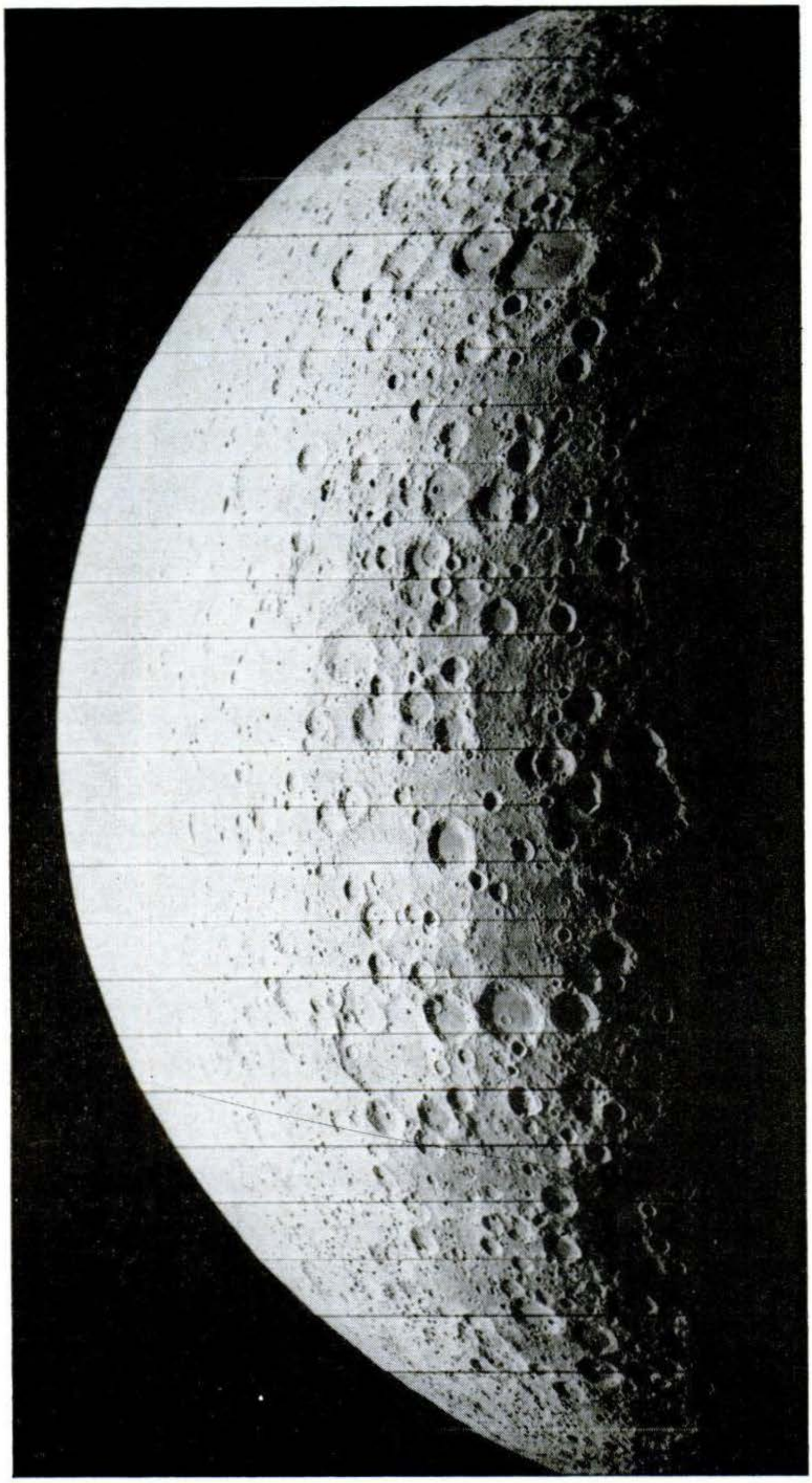

A new view of the other side of the moon

For all the tens of thousands of years that man has dwelled on this earth, he never saw—until recently—what you are looking at in this photo. It's the other side of the moon, captured by the lenses of NASA's Lunar Orbiter V. The lighted portion—in sunlight—is about a fourth of the hidden side. Orbiter transmitted its shots to the Goldstone (Calif.) tracking station.

This plan lands on a cushio

Planes are sustai in the air by their wi ACVs—air-cushion hicles—are sustained a downward rush of that literally forms cushion platform. N Bell Aerosystems come up with a mach that is both plane ACV—or, more prope converts from one to other.

It has no wheels. landing gear is an in able-deflatable nyl and-rubber bag th shaped like a dough The source of air for cushion is a small, f cylinder engine in plane fuselage that tu a horizontally mour fan. The airflow ge ated by the fan is into the doughnut then escapes inwar the "hole" via hund of tiny nozzles. He a cushion of air. plane can land at forward speed. Its "r way" can be water, s or dirt. It can al amid tree stumps i area just big enoug accommodate the do nut. In a test vehicle, cushion air pressur only 50 pounds square foot. Bell lieves the idea ca applied to big c planes. The deflated hugs the plane's b in winged flight.

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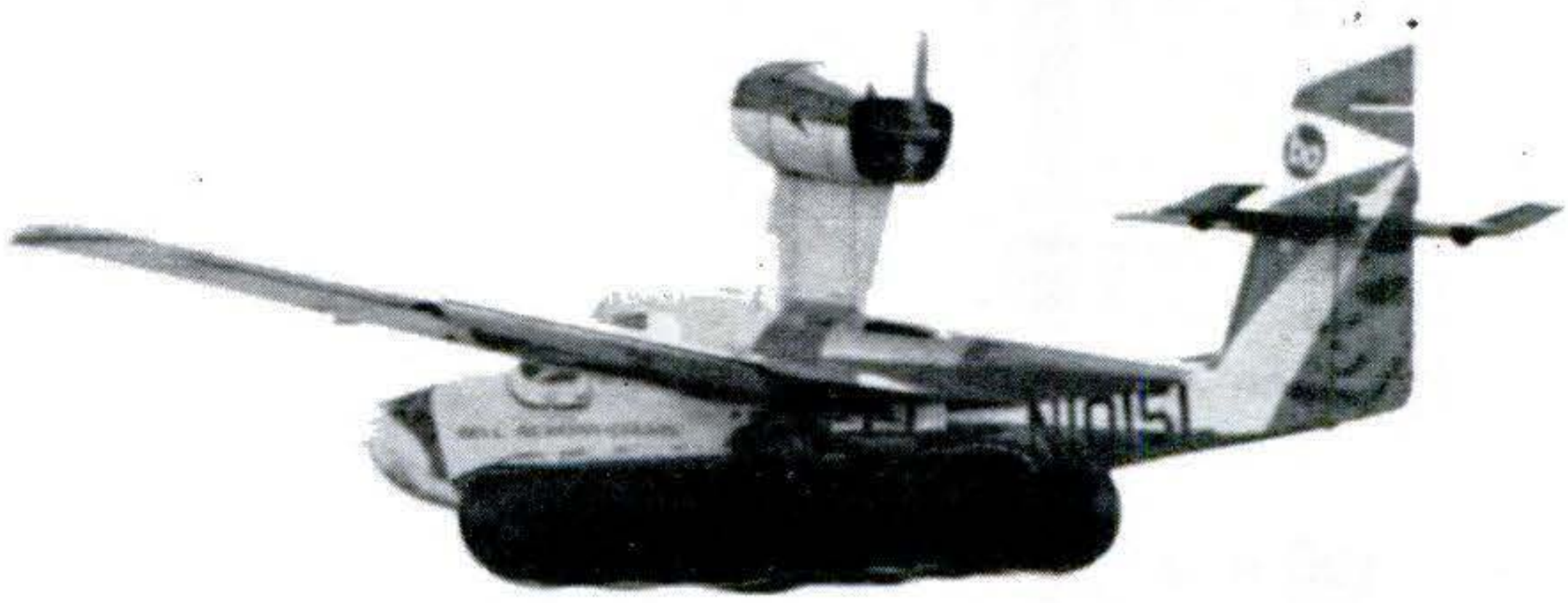

Wing-borne, the hybrid vehicle prepares to land. Doughnut-shaped bag is inflated . . .

Propeller pitch is reversed and plane speed is slowed to a crawl as plane nears ground . . .

Borne on cushion of air, plane comes to gentle landing. Process is reversed for takeoff.

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FACTS AND FIGURES ON TH

Dimensions

MAKE AND MODEL		WHEELBASE (in.)	TRACK, FRONT (in.)	TRACK, REAR (in.)	LENGTH (in.)	WIDTH (in.)	HEIGHT (in.)	CURB WEIGHT (lb.)	LEG ROOM (in.)		HEAD ROO (in.)	
									Front	Rear	Front	Rear
Ambassador	880/990/DPL	118	58.58	58.5	202.5	77.2	54.7	3,220	42.6	38.6	39.8	37
Buick	4-d Special/Skylark	116	59	59	204.6	75.5	53.6	3,265	42.3	35.9	38.6	37
	2-d Special/Skylark	112	59	59	200.6	75.5	52.8	3,263	42.1	33.1	37.8	36
	Le Sabre	123	63	63	217.5	80	54.3	4,107	42.2	39	38.9	37
	Wildcat	126	63.4	63	220.5	80	55.2	4,128	42.2	39	38.9	37
	Electra 225	126	63.4	63	224.9	80	55.8	4,438	42.2	40.3	39.5	38
	Riviera	119	63.4	63	215.2	78.8	53.4	4,334	41.2	36.6	38.1	37
Cadillac	Calais/de Ville	129.5	62.5	62.5	224.7	79.9	54.5	4,820	41	39.7	37.9	37
	Fleetwood 60	133	62.5	62.5	228.2	79.9	56.7	5,000	42	44.4	39.1	38
	Fleetwood 75	149.8	62.5	62.5	245.2	79.9	58.1	5,760	40.4		40.5	38
	Eldorado	120	63.5	63.0	221	79.9	53.8	4,620	40.9	36.2	37.7	37
Chevrolet	Corvair	108	55	56.6	183.3	69.7	51.3	2,555	40.9	30.7	37.9	36
	Chevy II	111	59	58.9	187.7	70.5	54.1	2,910	41.6	35.3	38.8	37
	Camaro	108	59	58.9	184.7	72.6	51.5	2,940	42.5	29.2	37	36
	4-d Chevelle	116	59	59	200.8	76	53.5	3,395	42.7	34.7	38.2	37
	2-d Chevelle	112	59	59	196.8	76	52.8	3,345	42.4	32.2	37.8	36
	Chevrolet	119	62.5	62.4	214.7	79.6	55.8	3,900	42.2	39.5	39.1	37
	Corvette	98	58.3	59	182.1	69.2	47.8	3,210	43		36	
Chrysler	Newport/New Yorker	124	62	60.7	219.2	78.6	55.9	4,380	41.8	38.9	39	37
	300	124	62	60.7	221.7	78.7	55.6	4,270	41.8	35.9	38.6	37
Dodge	Dart	111	58.1	56.3	195.4	69.7	52.8	2,860	41.7	35.7	38.3	37
	Coronet	117	59.5	59.2	210	76.7	56.4	3,205	41.9	36.3	38.6	37
	Charger	117	59.5	59.2	208	76.6	53.2	3,385	41.4	34.1	37.4	36
	Polara/Monaco	122	62	60.7	219	80	56.3	4,070	41.8	39	39.8	38
Ford	Falcon	111	58.8	58.5	184.3	73.5	55	2,669	42.4	33.9	38.8	37
	Mustang	108	58	58	183.6	70.9	51.6	2,696	42	27	37.4	35
	Fairlane	116	58.8	58.5	201	74.6	53.6	2,923	42.4	36	38.6	37
	Ford	119	62	62	213.3	78	55.8	3,685	41.9	37.6	38.9	37
	2-d Thunderbird	114.7	62	62	206.9	77.3	52.6	4,540	42.1	32.4	37.1	36
	4-d Thunderbird	117.2	62	62	209.4	77.3	53.4	4,545	42.1	35.5	38.1	36
Imperial		127	62.4	61.1	224.5	79.6	57	5,030	41.8	39.8	38.5	3
Javelin		109	58.4	57	189.2	71.9	52	2,700	43.3	31.5	37.5	3
Lincoln	Continental	126	62.1	61	221	79.7	54.9	5,147	41.3	41.7	38.5	3
Mercury	Cougar	111.1	58.1	58.1	190.3	71.3	51.8	3,240	42.7	28.7	37.3	35
	Montego	116	58.8	58.5	206.1	76	55	3,123	42.4	36	38.6	37
	Cyclone	116	58.8	58.5	203.1	76	53.6	3,407	42.4	33.8	37.4	36
	Mercury	123	62	62	220.1	77.9	56	4,084	41.9	37.6	38.9	37
Oldsmobile	4-d F-85	116	59	59	205.6	75.9	53.5	3,273	42.8	35.1	38.9	3
	2-d F-85	112	59	59	201.6	76.6	52.8	3,264	42.7	32.2	37.4	3
	Delmont/Delta	123	62.5	63	217.8	79.3	55.5	4,166	42.7	39	38.9	3
	98	126	62.5	63	223.7	79.7	55.8	4,538	42.2	40.5	39.6	3
	Toronado	119	63.5	63	211.4	76.4	52.8	4,472	41.2	36.6	37.9	3
Plymouth	Valiant/Signet	108	57.4	55.6	188.4	71.1	54	2,795	41.7	34.5	38.4	3
	Barracuda	108	57.4	55.6	192.8	71.6	52.7	2,950	41.5	30.3	37.7	3
	Belvedere	116	59.5	59.2	202.7	76.2	54.7	3,355	41.9	36.3	38.6	3
	Fury	119	62	60.7	213	77.7	56.3	3,650	41.8	35.9	38.6	3
Pontiac	Firebird	108.1	60	60	18[illegible].8	72.8	50	3,090	42.5	29.5	37	3
	4-d Tempest	116	60	60	204.7	74.8	52.5	3,287	41.5	33.8	38	3
	2-d Tempest	112	60	60	200.7	74.8	52.2	3,280	41.3	32.4	37.5	3
	Catalina	121	63	64	216.5	79.8	54.8	4,030	42.4	38.1	39.1	3
	Bonneville	124	63	64	223.5	79.8	53.8	4,260	42.4	37.7	38.2	3
	Grand Prix	121	63	64	216.3	79.8	53	4,240	42.3	35.2	37.9	3
Rambler	American	106	56.4	55.3	181	70.8	54.2	2,699	42	35	39	3
	Rebel	114	58.6	58.5	197	77.2	54.6	3,163	42.6	38.6	39.8	3

NOTES: All dimensions are for standard four-door sedans unless other indicated or four-door sedan is not available. Tire sizes are standard for sed

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68 CARS

The longest and widest cars are not growing longer and wider anymore, but you have a greater choice of models in all sizes

HIP ROOM (in.)		USABLE TRUNK SPACE (cu. ft.)	TURNING DIAMETER (ft.)	STEERING RATIO OVERALL (:1)		TIRE SIZE	FUEL TANK (gal.)	AXLE RATIO STD. SIX		AXLE RATIO STD. V-8		OPTIONAL RATIOS		
Front	Rear			Manual	Power			Manual	Auto.	Manual	Auto.	Economy	Performance	
60.3	60.4	18.2	39	28.6	20.9	7.75x14	21.5	3.15	3.15	3.15	3.15	2.87	3.54	
58.5	59.3	13.5	39	28.6	20.9	7.75x14	20	3.23	2.93	2.93	2.56	2.73	3.91	3.42
60	59.5	13.7	38.4	28.6	20.9	7.75x14	20	3.23	2.93	2.93	2.56	2.73	3.91	3.42
63.7	62.9	16.2	42.2	33	20.5	8.45x15	25	—	—	3.23	2.93	2.73	3.91	3.42
63.7	62.9	16.2	44	33.4	18.9	8.45x15	25	—	—	3.07	3.07	2.78	3.91	3.42
63.7	62.4	17.0	44	—	18.9	8.85x15	25	—	—	—	2.78	2.56	3.91	3.42
62.2	54.4	10.1	42.3	—	19	8.45x15	21	—	—	—	3.07		3.91	3.42
63.6	62.7	18.1	45.8	—	16.6	9.00x15	26	—	—	—	2.94			
63.6	62.4	14.5	44.7	—	16.6	9.00x15	26	—	—	—	2.94			
63.6	57.7	17.2	54.4	—	18.2	8.20x15	26	—	—	—	3.21			
62.2	55.2	13.5	41.3	—	16.3	9.00x15	24	—	—	—	3.07			
56.1	54.9	7	37	23.3	—	7.00x13	14	3.55	3.27	—	—		3.55	
56.7	55.1	12.4	38.4	28.2	20.6	7.35x14	18	3.08	2.73	3.08	2.73	2.56	3.55	3.73 4.10
56.3	54.6	8.3	37	28.2	20.6	7.35x14	18	3.08	2.73	3.08	2.73	2.56	3.55	3.73 4.10
59.6	59.6	12.8	40.6	28	20.4	7.35x14	20	3.36	3.08	3.08	3.08	2.73	3.36	3.55 3.70
59.8	58.5	12.8	39.4	28	20.4	7.35x14	20	3.36	3.08	3.08	3.08	2.73	3.36	3.55 3.70
63.9	62.9	18.3	40.8	30.7	21.2	8.25x14	24	3.08	3.36	3.08	3.36	2.73	3.36	3.55 3.70
48.8	—		39.9	20.2	17.6	7.75x15	20	—	—	3.36	3.08	2.73	3.55	3.70 4.11
63.2	60	16.5	44.3	29.2	19.1	8.55x14	25	—	—	3.23	2.76			
63.2	60	16.5	44.1	29.2	19.1	8.55x14	25	—	—	3.23	2.76			
57.2	57.2	14.1	38.7	28.7	18.8	6.50x13	18	3.23	2.76	2.93	2.93		3.55	3.91
60.4	60.4	16.2	40.9	28.8	19.1	7.35x14	19	3.23	2.94	3.23	2.94		3.55	
60.4	60.4	16.2	40.9	28.8	19.1	7.35x14	19	—	—	2.94	2.76		3.23	3.55
63.3	63.3	17.1	43.5	29.2	19.1	8.25x14	25	—	—	3.23	2.94	2.76	3.55	
59.5	59.5	12.3	39.8	29.4	21.4	6.95x14	16	3.20	2.83	2.79	2.79		3.00	3.20 3.25
54	50.8	9.3	37.6	25.4	20.5	6.95x14	17	3.20	2.83	2.79	2.79	2.75	3.00	3.25 3.50
59.5	59.5	16.2	41.5	29.4	21.6	7.35x14	20	3.20	2.83	2.79	2.79		3.00	3.25 3.50
62.6	62.7	19.1	41	30.9	21.9	7.75x15	25	3.10	2.80	3.10	2.80			3.25 3.50
58.3	56.8	12.3	42.3	—	20.4	8.15x15	24.1	—	—	—	3.00	2.50		
57.8	58	12.3	43.1	—	20.4	8.15x15	24.1	—	—	—	3.00	2.50		
63.2	62.4	16.8	44.9	—	19.1	9.15x15	25	—	—	—	2.94			
57.6	56.38	10.2	36.8	24.1	17.1	6.95x14	19	3.08	3.08	3.15	3.15	2.87	3.31	3.54
61.8	61.8	18	47.4	—	20.5	9.15x15	25.5				2.80		3.00	
54.2	51.7	9.2	39.2	25.3	20.3	7.35x14	17	—	—	2.79	3.00	2.75	3.25	
59.5	59.5	17.1	41.5	29.4	21.6	7.35x14	20	3.20	2.83	2.79	2.79		3.00	3.25 3.50
58.8	58.4	17	41.5	29.4	21.6	7.35x14	20	3.20	2.83	2.79	2.79		3.00	3.25 3.50
62.6	62.7	19.1	43.6	31	22.1	8.15x15	25	—	—	3.00	2.75		3.25	3.50
59.5	59.4	17.5	41.2	28.3	20.7	7.75x14	20	2.78	2.78	3.08	2.56		3.23	3.42 3.91
59.5	58.4	17.5	40	28.3	20.7	7.75x14	20	2.78	2.78	3.08	2.56		3.23	3.42 3.91
63.7	62.9	19	45.4	33.4	21.74	8.55x14	20	—	—	3.23	2.78	2.56	3.73	
63.7	62.6	20.1	46.9	—	21.74	8.85x14	25	—	—	—	2.56		2.73	3.08 3.23
62.2	55.6	14.5	42.9	—	17.8	8.85x15	24	—	—	—	3.07		3.36	
57.1	57	14.5	37.8	28.7	18.8	6.50x13	18	3.23	2.76	2.93	2.93		3.55	3.91
57.1	57.1	15.2	38	28.7	18.8	6.95x14	18	3.23	2.76	3.23	2.76		3.55	3.91
60.4	60.4	15.6	40.6	28.8	18.1	7.35x14	19	3.23	2.93	3.23	2.94		3.55	3.54
63.2	62.4	19.7	42.8	29.2	19.1	8.25x14	24	3.23	3.23	3.23	2.94	2.76	3.31	3.55
56.3	54.6	9.9	38.5	24	17.5	E70x14	18.5	3.55	3.23	3.55	3.23	2.41	3.90	
59.9	59.9	13.1	40.9	24	17.5	7.75x14	21.5	3.23	2.76	3.23	2.76	2.56	3.55	3.36 4.33
59.9	58.6	14.5	40.9	24	17.5	7.75x14	21.5	3.23	2.76	3.23	2.76	2.56	3.55	3.36 4.33
63.8	62.4	18.9	42.8	29.8	21.7	8.55x14	26.5	—	—	3.23	2.29		3.42	
63.8	62.5	20.9	43.7	29.8	19.8/15.1	8.55x14	26.5	—	—	3.23	2.29		3.42	
63.8	55.3	17.0	42.8	29.8	19.8/15.1	8.55x14	26.5	—	—	3.23	2.29		3.42	
57.4	57.1	12	36	29.1	21.1	6.45x14	16	3.08	3.08	3.15	3.15	2.73	3.54	
60.3	60.4	18.2	37.5	28.6	20.9	7.35x14	21.5	3.15	3.15	3.15	3.15	2.87	3.54	

urb weights include typical equipment, such as V-8 engines and automatic ansmissions.

Continued

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Power Units

MAKE	ENGINE TYPE	DISPLCEMENT (cu. in.)	BORE AND STROKE	COMPRESSION RATIO (:1)	FUEL RECOMMENDED	CARBURETION		VALVE LIFTERS	HORSEPOWER AT R.P.M
AMERICAN MOTORS CORPORATION	OHV 6	199	3.75x3.00	8.5	R	Holley	1-bbl.	Hydr	128 @ 4,400
	OHV 6	232	3.75x3.50	8.5	R	Holley	1-bbl.	Hydr	145 @ 4,300
	OHV 6	232	3.75x3.50	8.5	R	Carter	2-bbl.	Hydr	155 @ 4,400
	OHV V-8	290	3.75x3.28	9.0	R	Holley	2-bbl.	Hydr	200 @ 4,600
	OHV V-8	290	3.75x3.28	10.0	P	Carter	4-bbl.	Hydr	225 @ 4,700
	OHV V-8	343	4.08x3.28	9.0	R	Holley	2-bbl.	Hydr	235 @ 4,400
	OHV V-8	343	4.08x3.28	10.2	P	Carter	4 bbl.	Hydr	280 @ 4,800
BUICK	OHV 6	250	3.875x3.53	8.5	R	Rochester	1-bbl.	Hydr	155 @ 4,200
	OHV V-8	350	3.80x3.85	9.0	R	Rochester	2-bbl.	Hydr	230 @ 4,400
	OHV V-8	350	3.80x3.85	10.25	P	Rochester	4-bbl.	Hydr	285 @ 4,800
	OHV V-8	400	4.04x3.90	10.25	P	Rochester	4-bbl.	Hydr	340 @ 5,000
	OHV V-8	430	4.1875x3.90	10.25	P	Rochester	4-bbl.	Hydr	360 @ 5,000
CADILLAC	OHV V-8	472	4.30x4.06	10.5	P	Rochester	4-bbl.	Hydr	375 @ 4,400
CHEVROLET	OHV Flat Six	164	3.4375x2.94	8.25	R	2 Rochester	1-bbl.	Hydr	95 @ 3,600
	OHV Flat Six	164	3.4375x2.94	9.25	P	2 Rochester	1-bbl.	Hydr	110 @ 4,400
	OHV Flat Six	164	3.4375x2.94	9.25	P	4 Rochester	1-bbl.	Hydr	140 @ 5,200
	OHV 4	153	3.875x3.25	8.5	R	Rochester	1-bbl.	Hydr	90 @ 4,000
	OHV 6	230	3.85x3.25	8.5	R	Rochester	1-bbl.	Hydr	140 @ 4,400
	OHV 6	250	3.875x3.53	8.5	R	Rochester	1-bbl.	Hydr	155 @ 4,200
	OHV V-8	307	3.875x3.25	9.0	R	Rochester	2-bbl.	Hydr	200 @ 4,600
	OHV V-8	327	4.00x3.25	8.75	R	Rochester	2-bbl.	Hydr	210 @ 4,600
	OHV V-8	327	4.00x3.25	8.75	R	Rochester	4-bbl.	Hydr	250 @ 4,800
	OHV V-8	327	4.00x3.25	10.0	P	Rochester	4-bbl.	Hydr	275 @ 4,800
	OHV V-8	327	4.00x3.25	10.0	P	Rochester	4-bbl.	Hydr	300 @ 5,000
	OHV V-8	327	4.00x3.25	11.0	P	Rochester	4-bbl.	Hydr	325 @ 5,600
	OHV V-8	327	4.00x3.25	11.0	P	Rochester	4-bbl.	Hydr	350 @ 5,800
	OHV V-8	350	4.00x3.48	10.25	P	Rochester	4-bbl.	Hydr	295 @ 4,800
	OHV V-8	396	4.094x3.76	10.25	P	Rochester	4-bbl.	Hydr	325 @ 4,800
	OHV V-8	396	4.094x3.76	10.25	P	Rochester	4-bbl.	Hydr	350 @ 5,200
	OHV V-8	427	4.251x3.76	10.25	P	Rochester	4-bbl.	Hydr	385 @ 5,200
	OHV V-8	427	4.251x3.76	10.25	P	Rochester	4-bbl.	Hydr	390 @ 5,400
	OHV V-8	427	4.251x3.76	10.25	P	Holley	4-bbl.	Hydr	400 @ 5,400
	OHV V-8	427	4.251x3.76	10.25	P	Holley	4-bbl.	Hydr	435 @ 5,800
CHRYSLER CORPORATION	OHV 6	170	3.40x3.125	8.5	R	Ball & Ball	1-bbl.	Mech	115 @ 4,400
	OHV 6	225	3.40x4.125	8.4	R	Holley	1-bbl.	Mech	145 @ 4,000
	OHV V-8	273	3.63x3.31	9.0	R	Ball & Ball	2-bbl.	Hydr	190 @ 4,400
	OHV V-8	318	3.91x3.31	9.2	R	Ball & Ball	2-bbl.	Hydr	230 @ 4,400
	OHV V-8	340	4.04x3.31	10.5	P	Carter	4-bbl.	Hydr	275 @ 5,000
	OHV V-8	383	4.25x3.38	9.2	R	Ball & Ball	2-bbl.	Hydr	290 @ 4,400
	OHV V-8	383	4.25x3.38	10.0	P	Carter	4-bbl.	Hydr	300 @ 4,400
	OHV V-8	383	4.25x3.38	10.0	P	Carter	4-bbl.	Hydr	330 @ 5,000
	OHV V-8	383	4.25x3.38	10.0	P	Carter	4-bbl.	Hydr	335 @ 5,200
	OHV V-8	426	4.25x3.75	10.25	P	2 Carter	4-bbl.	Mech	425 @ 5,000
	OHV V-8	440	4.32x3.75	10.1	P	Carter	4-bbl.	Hydr	375 @ 4,600
	OHV V-8	440	4.32x3.75	10.0	P	Carter	4-bbl.	Hydr	350 @ 4,400
FORD MOTOR COMPANY	OHV 6	170	3.50x2.94	8.7	R	Ford	1-bbl.	Hydr	100 @ 4,000
	OHV 6	200	3.68x3.13	8.8	R	Ford	1-bbl.	Hydr	115 @ 3,800
	OHV 6	240	4.00x3.18	9.2	R	Ford	1-bbl.	Hydr	150 @ 4,000
	OHV V-8	289	4.00x2.87	8.7	R	Ford	2-bbl.	Hydr	195 @ 4,600
	OHV V-8	302	4.00x3.00	9.0	R	Ford	2-bbl.	Hydr	210 @ 4,600
	OHV V-8	302	4.00x3.00	10.0	R	Ford	4-bbl.	Hydr	230 @ 4,800
	OHV V-8	390	4.05x3.78	9.5	R	Ford	2-bbl.	Hydr	265 @ 4,400
	OHV V-8	390	4.05x3.78	10.5	P	Ford	2-bbl.	Hydr	280 @ 4,400
	OHV V-8	390	4.05x3.78	10.5	P	Ford	4-bbl.	Hydr	315 @ 4,600
	OHV V-8	390	4.05x3.78	10.5	P	Holley	4-bbl.	Hydr	335 @ 4,800
	OHV V-8	427	4.23x3.78	10.9	P	Ford	4-bbl.	Hydr	390 @ 5,600
	OHV V-8	428	4.13x3.98	10.5	P	Ford	4-bbl.	Hydr	340 @ 4,600
	OHV V-8	428	4.13x3.98	10.5	P	Ford	4-bbl.	Hydr	360 @ 5,400
	OHV V-8	429	4.36x3.59	10.5	P	Ford	4-bbl.	Hydr	360 @ 4,600
	OHV V-8	462	4.38x3.83	10.3	P	Carter	4-bbl.	Hydr	340 @ 4,600
OLDSMOBILE	OHV 6	250	3.875x3.53	8.5	R	Rochester	1-bbl.	Hydr	155 @ 4,200
	OHV V-8	350	4.057x3.385	9.0	R	Rochester	2-bbl.	Hydr	250 @ 4,400
	OHV V-8	350	4.057x3.385	10.25	P	Rochester	4-bbl.	Hydr	310 @ 4,800
	OHV V-8	400	3.87x4.25	9.0	R	Rochester	2-bbl.	Hydr	290 @ 4,600
	OHV V-8	400	3.87x4.25	10.5	P	Rochester	4-bbl.	Hydr	350 @ 4,800
	OHV V-8	400	3.87x4.25	10.5	P	Rochester	4-bbl.	Hydr	360 @ 5,400
	OHV V-8	455	4.125x4.25	9.0	R	Rochester	2-bbl.	Hydr	310 @ 4,200
	OHV V-8	455	4.125x4.25	10.25	P	Rochester	2-bbl.	Hydr	320 @ 4,200
	OHV V-8	455	4.125x4.25	10.25	P	Rochester	4-bbl.	Hydr	365 @ 4,600
	OHV V-8	455	4.126x4.25	10.25	P	Rochester	4-bbl.	Hydr	375 @ 4,600
	OHV V-8	455	4.126x4.25	10.25	P	Rochester	4-bbl.	Hydr	400 @ 4,800
PONTIAC	SOHC 6	250	3.87x3.53	9.0	R	Rochester	1-bbl.	Hydr	175 @ 4,800
	SOHC 6	250	3.87x3.53	10.5	R	Rochester	4-bbl.	Hydr	215 @ 5,200
	OHV V-8	350	3.87x3.75	9.2	R	Rochester	2-bbl.	Hydr	265 @ 4,600
	OHV V-8	350	3.87x3.75	10.5	P	Rochester	4-bbl.	Hydr	320 @ 5,100
	OHV V-8	400	4.12x3.75	10.75	P	Rochester	4-bbl.	Hydr	330 @ 4,800
	OHV V-8	400	4.12x3.75	8.6	R	Rochester	2-bbl.	Hydr	265 @ 4,600
	OHV V-8	400	4.12x3.75	10.5	P	Rochester	2-bbl.	Hydr	290 @ 4,600
	OHV V-8	400	4.12x3.75	10.5	P	Rochester	4-bbl.	Hydr	340 @ 4,800
	OHV V-8	400	4.12x3.75	10.5	P	Rochester	4-bbl.	Hydr	350 @ 5,000
	OHV V-8	400	4.12x3.75	10.75	P	Rochester	4-bbl.	Hydr	360 @ 5,400
	OHV V-8	428	4.12x4.00	10.5	P	Rochester	4-bbl.	Hydr	375 @ 4,800
	OHV V-8	428	4.12x4.00	10.75	P	Rochester	4-bbl.	Hydr	390 @ 5,200

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rsepower—in 43 basically different engines for 48 distinct car lines

TORQUE AT R.P.M.	STANDARD ON	OPTIONAL ON
182 @ 1,600	American	None
215 @ 1,600	Rebel, Javelin, Ambassador	American
222 @ 1,600	None	Rebel, Ambassador
285 @ 2,800	All	None
300 @ 3,200	None	American, Javelin
345 @ 2,600	None	Rebel, Ambassador
365 @ 3,000	None	Javelin, Rebel, Ambassador
235 @ 1,600	Special, Skylark	None
350 @ 2,400	Special, Skylark, Le Sabre	None
375 @ 3,200	Skylark GS "350"	Special, Skylark, Le Sabre
440 @ 3,200	Skylark GS "400"	None
475 @ 3,200	Wildcat, Electra, Riviera	None
525 @ 3,000	All	None
154 @ 2,400	Corvair	None
160 @ 2,800	None	Corvair
160 @ 3,600	None	Corvair
152 @ 2 400	Chevy II	None
220 @ 1,600	Chevy II, Camaro, Chevelle	None
235 @ 1,600	Chevrolet	Chevy II, Camaro, Chevelle
300 @ 2,400	Chevy II, Chevelle, Chevrolet	None
320 @ 2,400	Camaro	None
335 @ 3,200	None	Chevrolet
355 @ 3,200	None	Chevy II, Camaro, Chevelle, Chevrolet
360 @ 3,400	Corvette	None
355 @ 3,600	None	Chevelle
360 @ 3,600	None	Corvette
380 @ 3,200	None	Chevy II, Camaro
410 @ 3,200	None	Camaro, Chevelle, Chevrolet
415 @ 3,400	Chevelle SS 396	None
460 @ 3,400	None	Chevrolet
460 @ 3,600	None	Corvette
460 @ 3,600	None	Corvette
460 @ 4,000	None	Corvette
155 @ 2,400	Valiant, Dart	None
215 @ 2,400	Belvedere, Coronet, Plymouth, Charger	Valiant, Dart
260 @ 2,000	Belvedere, Coronet, Charger, Valiant, Dart, Barracuda	None
340 @ 2,400	Plymouth, Dodge	Valiant, Dart, Belvedere, Charger, Coronet
340 @ 3,200	None	Barracuda, Dart
390 @ 2,800	Chrysler, Newport	Belvedere, Coronet, Charger, Dodge, Plymouth
400 @ 2,400	None	Barracuda, Dart
425 @ 3,200	Chrysler, New Yorker	Belvedere, Coronet, Plymouth, Dodge, Charger
425 @ 3,400	None	Coronet, Charger, Belvedere
490 @ 4,000	None	Coronet, Charger, Belvedere
480 @ 3,200	None	Coronet, Charger, Belvedere, Chrysler, Plymouth, Dodge
480 @ 2,800	Chrysler 300, Imperial	Plymouth, Dodge, Chrysler
156 @ 2,200	Falcon	None
190 @ 2 200	Fairlane, Mustang, Montego, Comet	Falcon
234 @ 2,200	Ford	None
288 @ 2,600	None	Fairlane, Falcon, Mustang
300 @ 2,600	LTD, Cougar	Fairlane, Ford, Montego
310 @ 2,800	None	Falcon, Mustang, Montego, Cougar
390 @ 2,600	Monterey, Montclair	Ford, Fairlane, Montego
403 @ 2,600	None	Cougar
427 @ 2,800	Thunderbird, Marquis, Park Lane	Ford, Fairlane
427 @ 3,200	None	Mustang, Cougar, Montego
460 @ 3,200	None	Ford, Fairlane, Mustang, Montego, Cougar, Comet
462 @ 2,800	None	Ford, Mercury
459 @ 3,200	Mercury Police Interceptor	None
480 @ 2,800	None	Thunderbird
485 @ 2,800	Lincoln	None
240 @ 2,000	F-85, Cutlass	None
355 @ 2,600	Delmont, Cutlass, F-85	Cutlass Supreme
390 @ 3,200	Cutlass Supreme	Delmont
425 @ 2,400	None	4-4-2
440 @ 3,200	4-4-2	None
440 @ 3,600	None	4-4-2
490 @ 2,400	Delta	None
500 @ 2,400	None	Delta
510 @ 3,000	98	None
510 @ 3,000	Toronado	None
500 @ 3,200	None	Toronado
240 @ 2,600	Firebird, Tempest	None
255 @ 3,800	None	Firebird, Tempest
355 @ 2,800	None	Firebird, Tempest
380 @ 3,200	None	Firebird, Tempest
430 @ 3,300	None	Firebird
397 @ 2,400	None	GTO
428 @ 2,500	Catalina	None
445 @ 2,900	Bonneville	None
445 @ 3,000	GTO, Grand Prix	None
445 @ 3,800	None	GTO
472 @ 3,200	None	Catalina, Bonneville, Executive, Grand Prix
465 @ 3,400	None	Catalina, Bonneville, Executive, Grand Prix

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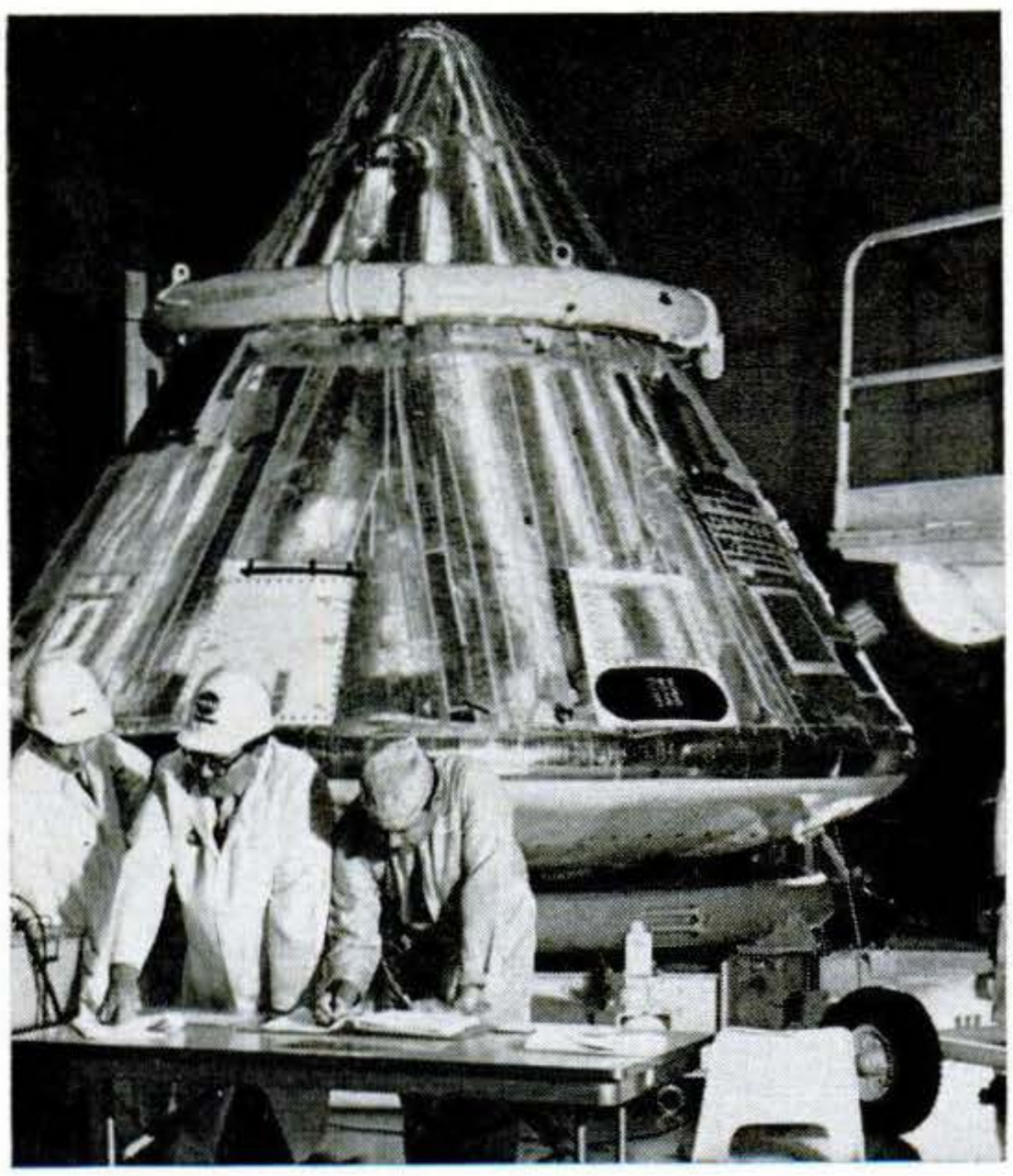
Quick-escape hatch for new Apollo, unlatched by pump-handle lever on near side, opens in three seconds. Viewing it, above, are astronaut Walter Schirra (hand on vent valve) and NASA and NAA engineers.

The Inside Story



Unmanned Apollo 4, outwardly a duplicate of new Apollo 101's Command Module, is readied to test its heat shield in dive from space to earth. New silvery coating serves for thermal protection in space.

A PS reporter takes you into North American Aviation's plant for a first look at how a fatal fire's lessons have remodeled our man-to-the-moon spacecraft

By PAUL DITZEL

Next spring or summer, our Apollo Spacecraft 101 will carry astronauts Walter Schirra, Donn Eisele, and Walter Cunningham aloft on the first manned Apollo mission, a space flight of up to two weeks in earth orbit. Due for delivery late this year to Cape Kennedy, where several months of checkout tests will follow, the spacecraft will be of radically new design.

Apollo 101 will embody all the drastic changes devised to prevent a repeti-

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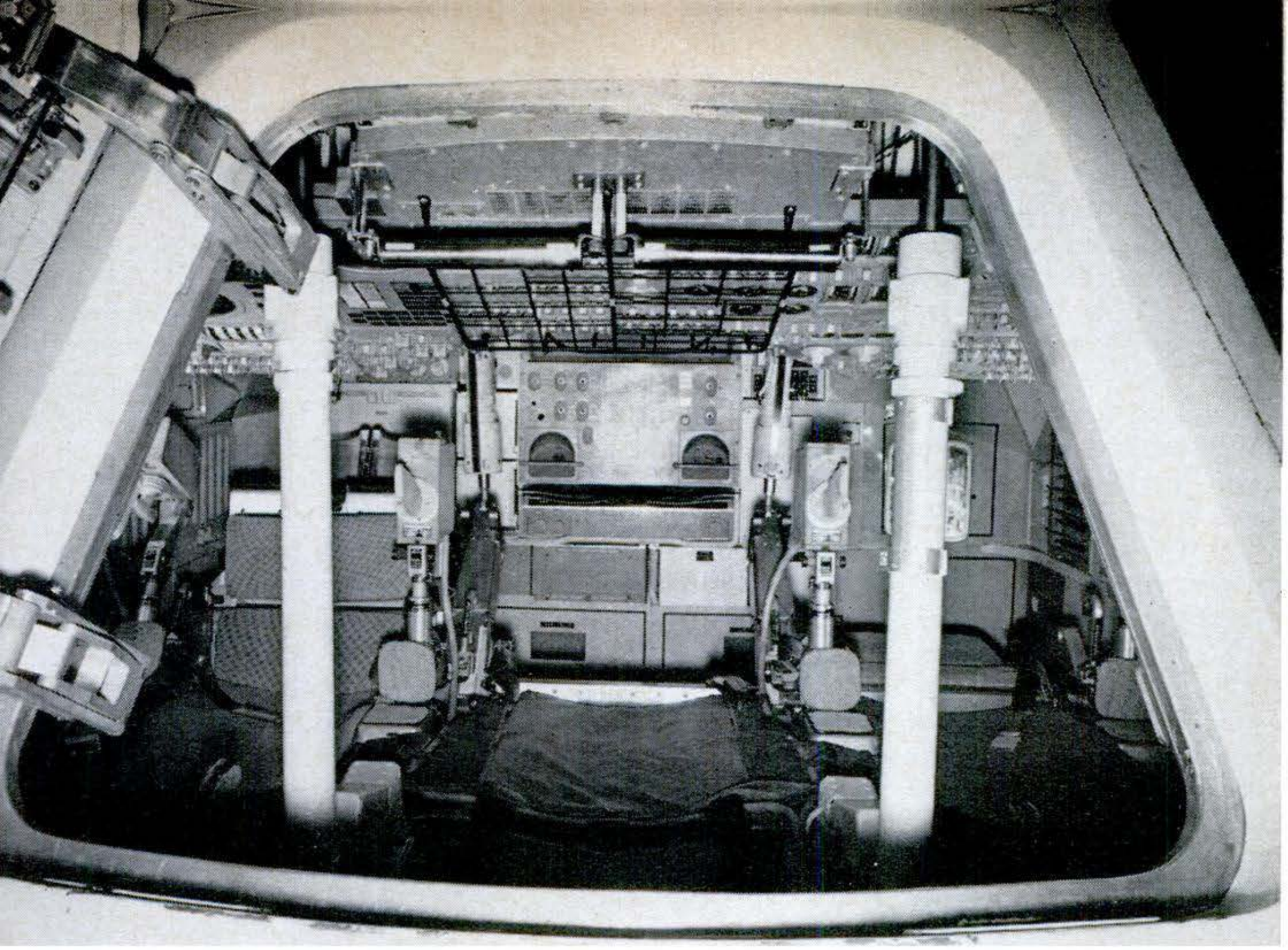

Peek through hatchway of Apollo 101 mock-up, showing main display panels and couches, gives preview of what the new cabin will look like. Hinges of new one-piece hatch are seen at left of the opening.

of the NEW APOLLO

tion of the Apollo fire that snuffed out the lives of three astronauts last January 27. What are those changes, and what will the new Apollo be like?

For a firsthand view, I recently visited the sprawling plant of North American Aviation, Apollo's builder, at Downey, Calif. Donning a canary-yellow plastic coat, and slipping a plastic bag over my hair, I was led past security guards and through a maze of corridors and turnstiles. I paused to be picked clean of dust by mechanical devices—a shoe cleaner, a suction grating in the floor, vacuum cups in the walls. Only then was I permitted to enter the mammoth two-million-cubic-foot "clean room," the world's largest, where Apollo 101 was being assembled.

The new Apollo's Command Module is still a cone about 12 feet tall and 13 feet across at its base—its outer heat shield a honeycomb of stainless steel, its inner compartment an aluminum honeycomb. Similarities to the old Command Module virtually end right there.

Quick-escape hatch. The most dramatic change, a new fast-opening hatch, affords quick escape from the capsule in a launch-pad emergency.

The astronaut on the center couch or on the right-hand one can now reach up and pull a pump-handle lever that simultaneously unlocks the hatch and breaks the pressure seal. Opening the hatch takes only three seconds. Practice fire drills by the new Apollo team show they can escape through the hatch, with pad-crew aid, in 15 to 25 seconds.

Contrast this with the 90 seconds it took to unlock the former multi-layered Apollo hatch and emerge. When fire swept the interior of the old Apollo, during a checkout on the pad, astronauts Grissom, White, and Chaffee died of smoke inhalation before they could get the hatch open.

Ground or recovery crews can open the new hatch from the outside, with a

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small hand tool, in less than 10 seconds. It took pad rescue crews five awful minutes in January's disaster.

The old hatch had an outward-opening exterior door and also, to hold normal cabin pressure, an inward-opening interior door. Even if the trapped astronauts had had time to unlock the hatch, they could not have opened the inner door against the rising cabin pressure from the fire's heat. The excess pressure would have had to be vented first. Actually, it built up instead, until it ruptured the capsule.

The new hatch corrects those tragic faults. Its single door seals the cabin from the outside. Its weight, and pressure-seal friction, are counterbalanced by the force of gas stored under pressure in a piston chamber. So, when the "pump handle" has unlatched it, it swings open easily—through a generous 105 degrees instead of the older type's 90 degrees. Opening so fast, it would almost instantly rid a cabin of the lethal buildup of smoke and gas that killed the Apollo-fire victims.

Added to the new Apollo hatch is another feature. A built-in vent valve enables the astronauts to empty the crew compartment of its atmosphere within 90 seconds, considerably faster than in the old Apollo. One use could be extinguishing a fire in space.

The new hatch's design was chosen from several proposed. One idea was to blow the hatch open with a pyrotechnic device. The astronauts vetoed this—seeing danger of losing the hatch's protection in flight if high reentry heat triggered the device accidentally.

New fireproof materials. Combustible substances in the cabin stoked the Apollo fire. Nylon-type materials, thought safe after passing fire tests in the five-pound-pressure oxygen to be used in space, burst into flame in the 16-pound-pressure oxygen of the Apollo on the pad. Velcro, for anchoring objects in zero gravity, likewise passed the five-pound tests but went "phoof" in oxygen at the higher pressure.

The new Apollo's materials will be either self-extinguishing or slow-burning in pure 16-pound-pressure oxygen. Tests to select them are still in progress, and final decisions may not be made until close to the time of the first manned Apollo flight. Even then, research and development will continue.

Already, however, from fire tests in a full-scale mock-up of the spacecraft, two promising successors to nylon have emerged—Beta cloth, a form of fiber glass, and Teflon materials.

Beta and Teflon will probably replace nylon and rubber for couch pads. They may be used, instead of nylon, for sleep restraints, hose covers, and equipment bags. For food bags, Teflon may take the place of polyethylene.

Light-gauge aluminum boxes will be used, instead of nylon bags, to stow the astronauts' personal effects and flight gear. Metal could also replace Mylar in window shades.

Fireproof spacesuits. Already, too, new fireproof Apollo spacesuits have been designed—in which Beta cloth is definitely a principal material.

In contrast with the blue color of the earlier Apollo suit of high-termperature nylon, the new suit is white. It is bulkier than the old one, but the astronauts are finding it more comfortable, and it permits freer movement.

It has an outer layer of Beta fabric—which, flame tests show, has 10 times the fire resistance of the old nylon. The spacesuit's cotton underwear has also been replaced with Beta cloth.

This fabric's fire-resistant qualities have been known for at least five years, but its use in spacesuits has required solving special problems. One was its tendency to flake as the cloth was subjected to rubbing and flexing; in weightless flight, the flakes could be troublesome. So, to protect the new suit's areas of frequent abrasion, patches of metallic fiber cloth cover the elbows, knees, back, and shoulders.

Polyurethane has given way to fire-resistant carboxy-nitroso rubber in the soles of the astronauts' boots, and to a silicone material in their helmets.

Safer wiring. If a fire does occur in the new spacecraft, it will probably be ignited by an electric spark somewhere along the Command Module's 20 miles of wiring—as the fatal Apollo fire is thought to have been. The earlier cap-

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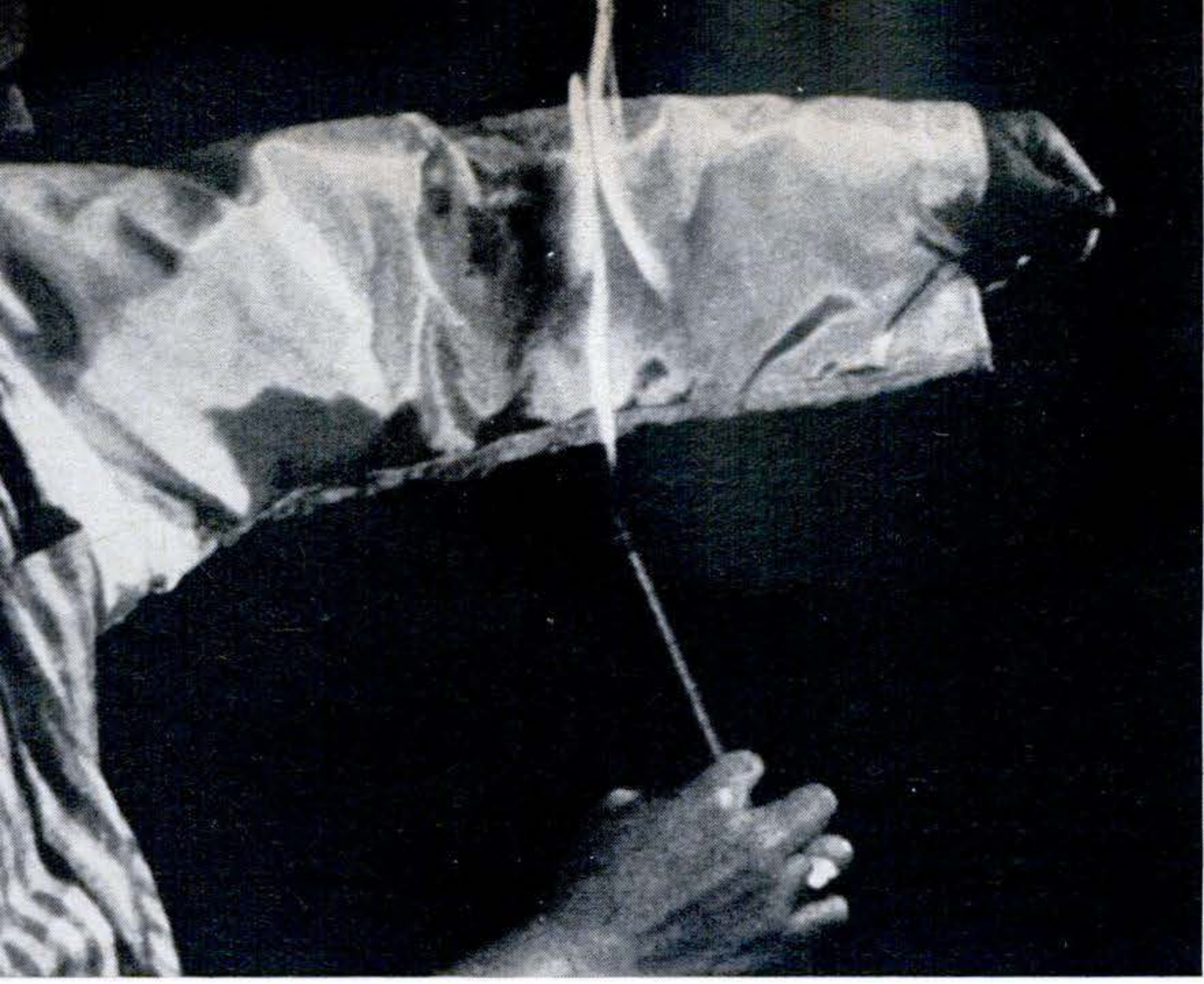

Fire test of Beta cloth, at NASA's Manned Spacecraft Center, demonstrates that it defies flame and is impervious to heat. New Apollo suit, at right, has outer layer and underwear of Beta cloth.

sule's wiring bundles were purposely left uncovered for ease of access and repair in flight. But (hindsight indicates) this risked chafed insulation and exposed nearby materials to fire from a resulting short circuit.

Now the bundles of wires run through troughs, sealed off from the cabin and compartmented by aluminum panels. A fire would be confined to a space perhaps no larger than a shoebox. The wiring has, moreover, the added protection of Teflon-impregnated insulation.

Wiring bundles have been rerouted and consolidated, and more circuit breakers added. NAA has improved the bundles' fabrication by using three-dimensional jigs. When ties of bundles need to be cut, a new tool clips them without putting strain on the wires.

Leakproof plumbing. Leaks of fluids—especially water-glycol coolant, which can be ignited at elevated temperature—will be minimized if not ended. Many plumbing joints have been eliminated, by combining segments into longer runs. Other joints are being armored with aluminum sleeves. Soft-metal washers and better torquing procedures will counter leaks at mechanical fittings. Quick-disconnects, with fluid check valves, will prevent spilling water-glycol in normal maintenance.

The pure-oxygen question. Apollo's 100-percent-oxygen cabin atmosphere aroused controversy during the fire inquiry. Pure oxygen, of course, offers more fire hazard than diluted oxygen or air—far more, at prelaunch 16-pound pressure, as at the time of the January fire.

Nearly everyone connected with the program is certain that the pure-oxygen system will be retained. The astronauts prefer it, and they are the ones who must fly the bird.

It is definite that 100-percent oxygen at five pounds' pressure will continue to be used during space flight. Entering into the decision to stick to pure oxygen was the necessity of increasing the size, weight, and complexity of the environmental control system if a changeover were made. One source told me that abandonment of the 100-percent-oxygen system would be tantamount to "somebody coming along and telling us we would have to boost a moonbound Apollo with something other than the Saturn V. It would be as totally disruptive to the whole program."

"The option might be available," says Dr. George E. Mueller, NASA associate administrator for manned space flight, "to use either air or 100-percent oxygen in ground tests, prelaunch, and launch."

Assuming that pure oxygen will be retained—with the possible option of nat-

Continued

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These aids help guard quality of workmanship in the new Apollo

New tie-cutting tool has been designed to snip ties of wire bundles for Apollo cabin, as pictured, without putting any strain on the delicate wires.

Form-fitting tool kit warns of tool left in craft by telltale empty space. Logged in and out, tools must be back in kit's pockets at end of work shift.

ural air before flight—Apollo's redesigners are safeguarding the oxygen system. Aluminum tubing, which melts at around 1,200 degrees F., is being replaced with stainless steel, which resists fire up to about 2,700 degrees. Exposed oxygen lines are getting protective coverings of Teflon tape.

Fire-fighting aids. While Apollo changes aim primarily to prevent a fire, and to provide quick escape if one does occur, work is going ahead on new fire-extinguishing equipment.

Tests of fire-fighting agents, including foams, carbon dioxide, and nitrogen, show water the most effective one. Just how it will be squirted on a fire is still to be worked out. The system is expected to be as simple as a hose and nozzle, drawing water from the spacecraft's regular supply. Or, possibly, water might be sprayed from a squirt gun or an aerosol can. Removable plugs in panels will enable astronauts to shoot water into confined spaces, so that droplets will not float about the cabin during weightlessness.

New oxygen masks—similar to those on aircraft—will protect the crew from smoke and toxic fumes in case of a fire while they are out of their spacesuits. The masks will be connected to the environmental control system.

Fire-rescue teams are being trained to speed getting the hatch open and the astronauts out, if need be. The launch umbilical tower and access arm are being modified. The "park" position has been moved nearer the spacecraft—and the mechanism souped up to speed emergency repositioning of the arm against the Command Module.

Checks on workmanship. NAA men still wince at mention of a wrench socket found lodged near wiring in the fire-blackened Apollo capsule. Now, plastic tool-kit pouches have been superseded by styrofoam cases with form-fitting tool trays. An empty space would warn of a tool left behind. And NAA is developing an idea to give tools a mild dose of radiation so they can be located, even if out of sight, by radiation-detecting Geiger counters.

The new Apollo's changes are proving very expensive, in more ways than just money.

Dead weight, the bugaboo of spacecraft designers, is going up. Each new spacesuit is five pounds heavier than the old one. The new hatch adds 85 pounds. All told, the changes boost the Command Module's weight from 12,000 to more than 13,000 pounds. One immediate consequence of the added load has been to require alterations, including larger drogue parachutes, in Apollo's earth-landing system.

In money, the changes are expected to add about $110 million to the project's cost. Spacesuits alone will account for some $8 million of this.

That is the price that planners feel must be paid, to make sure that a tragedy like the Apollo fire will never happen again. PS

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Here's the latest in Popular Science's series for the car owner who doesn't have a very clear idea about what goes on under the hood—but would like to learn. Knowing your car will save you money and add to your driving pleasure and safety.

ABCs of Keeping Your Car in Tune

SIXTH OF A SERIES

You turn the key and nothing happens—it's one of motoring's most frustrating experiences. A little regular maintenance on the electrical system is your best safeguard against such misery.

How to Take Care of the Electrical System

By HERB CARRIER

The tools you'll need: a cable-and-post cleaning tool, baking soda, petroleum jelly, voltmeter, and a few simple hand tools, like these wrenches.

Want easier starts? More life from your battery? Just spend a half-hour checking the electrical system

Ever turn your ignition key to "Start" and get only a click or groan? It happens every day to thousands of motorists. But it doesn't have to happen to you from now on. Here's a quick and

Continued

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easy maintenance program designed to keep you out of the click-and-cuss group. It will take you less than a half-hour twice a year, and it requires no special know-how or costly tools.

Your car's starting and charging circuits are separate and distinct, but they are so closely related that they can be considered as one. The starting circuit consists of the starting-motor assembly, the switch (a contact on the ignition switch and, on cars with automatic transmissions, a neutral safety switch), the battery, and connecting wires and cables.

The charging circuit consists of the same battery, the generator (or alternator), a regulator, and the connecting wires.

The starter circuit takes electricity out of the battery to start the engine. The charging circuit puts electricity back into the battery when the engine is running. The common problem of a dead battery is usually due to drawing out more electricity than is put back. A high-quality, well-maintained battery should last a full three years before it starts giving signs of failure.

Trouble signs. If your headlights flare with sudden increases in engine speed, starter action is sluggish, excessive cranking is needed to start, or cranking speed slows during starting, you have been neglecting your starting-generating circuits. You'll be the victim of a "can't start" soon, unless you make immediate corrections.

Engine-starting problems can stem from many malfunctions and troubles not attributable to the starting or generating circuits—a poor ignition system, say. But the battery is the most common cold-weather cause. If it is in a low state of charge, it will not put out sufficient voltage to satisfy the demands of both the starter motor and the ignition system. If it takes almost all the battery's power to operate the starter motor, there will be no power left for the ignition system.

The result is an engine with marginal cranking ability and a very weak spark during starting. Finally, of course, you'll end up with a run-down battery.

If the starter fails to work when you turn the key, the fault may lie in misalignment of the contacts in the neutral safety switch. Remove the cover, check cam positions relative to the transmission selector lever, and adjust if necessary.

A well-charged battery with satisfactory capacity working with a good starting system should be capable of several 20- to 30-second cranking periods at good cranking speeds with a 30-second rest between periods. A cranking motor can get pretty warm when working; operated continuously for just a few minutes, it can literally burn itself out. If an engine fails to start after a couple of cranking periods, the cause is probably something other than the starting-generating circuits—most likely gas or spark.

Battery service. Car batteries are "wet"; that is, they require an electrolyte (water and acid mix). The first

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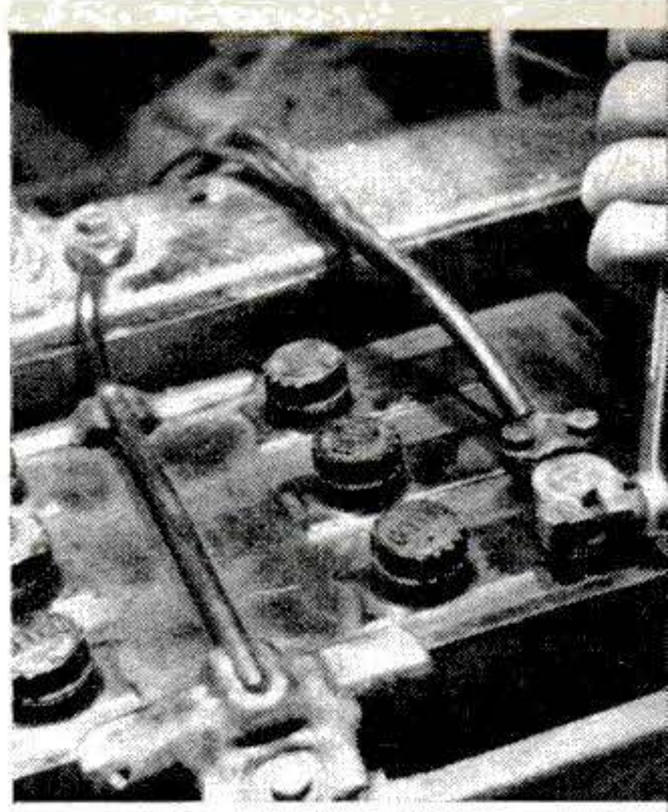
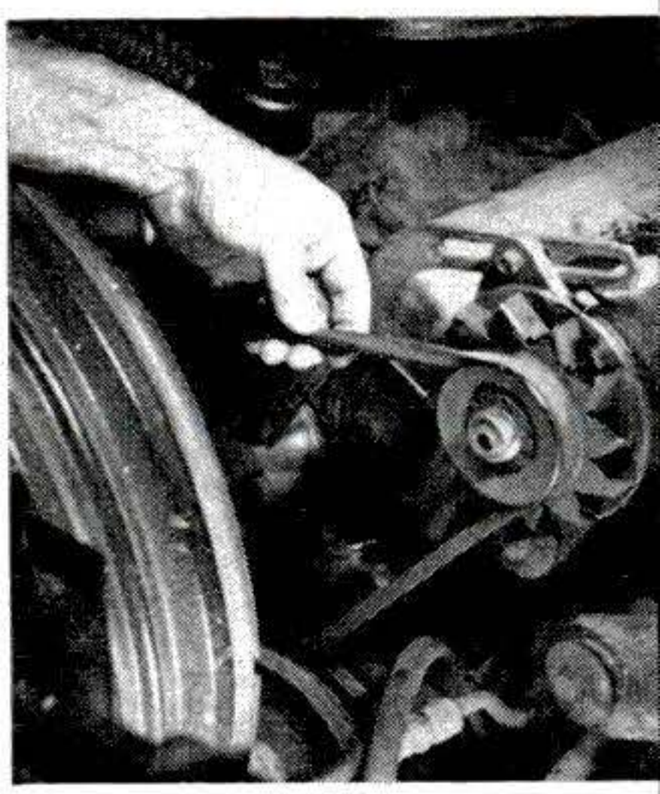
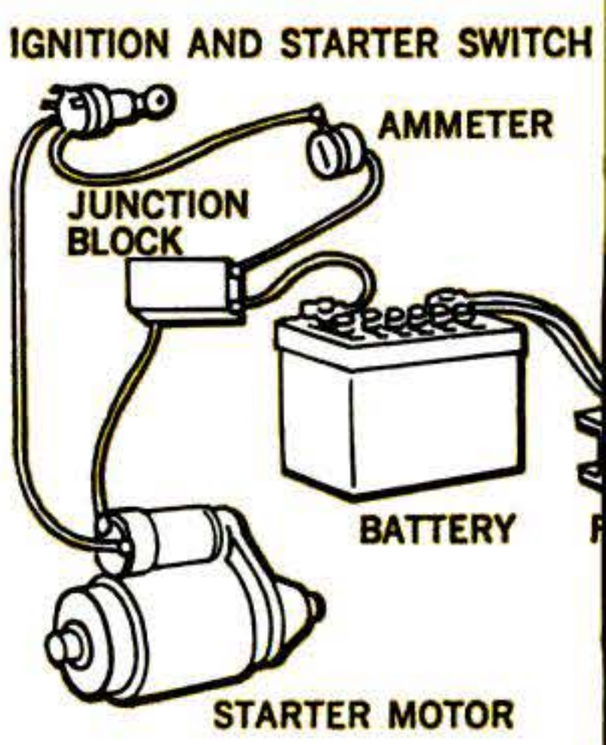


After cleaning the battery top, lo
en the cable clamps. One ca
uses a nut-and-bolt clamp;
opposite clamp is a spring-ty
Straight or special pliers can
used on the spring clamp.



Check alternator (shown here)
generator drive belt both for c
dition and proper adjustment.
full information on belt service,
your August '67 issue of Popu
Science. Replace worn belts.

Typical cranking circuit



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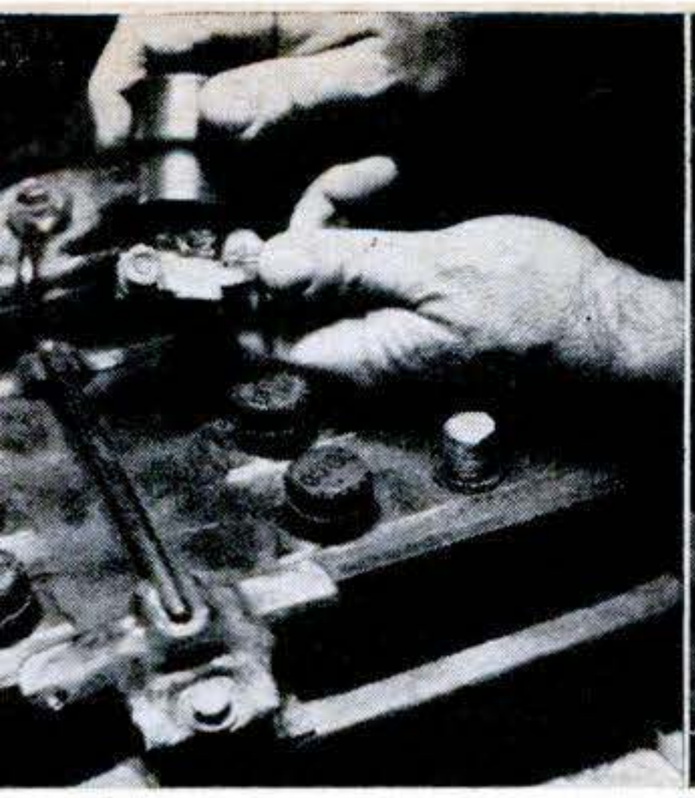
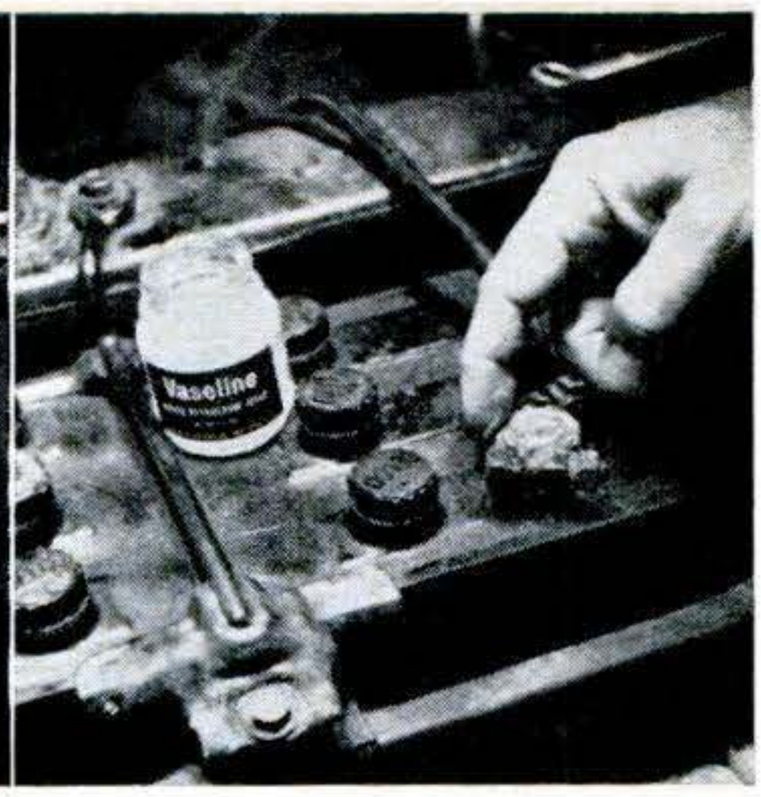
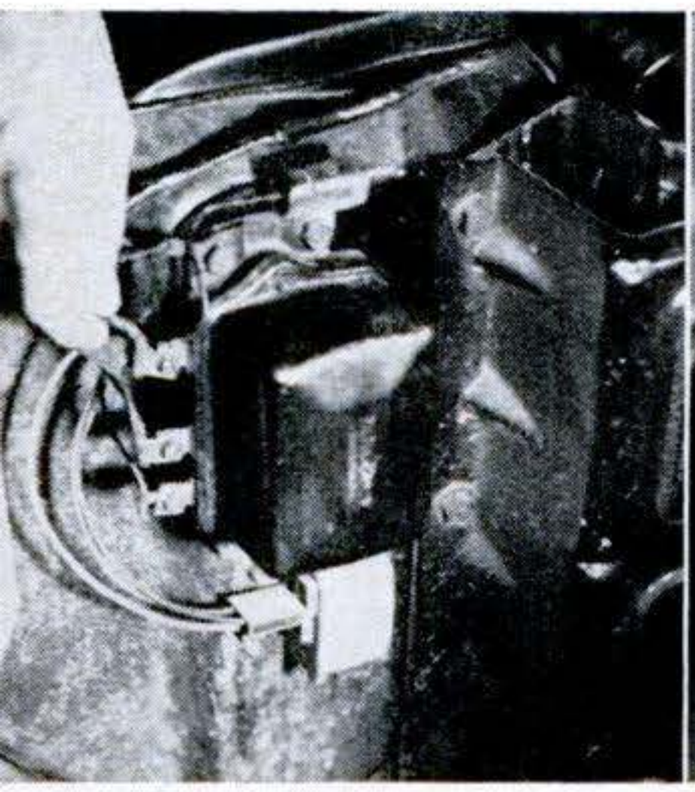


an the inside of the cable
nps and the battery-post area.
special but inexpensive clean-
tool shown above makes the
easier. Clean until the metal
faces shine brightly.

Some cables are clamped into the terminals. Remove the hold-down clamp and clean thoroughly. Tighten the clamp screws securely, then tighten—but don't overtighten—the battery hold-down bolts.

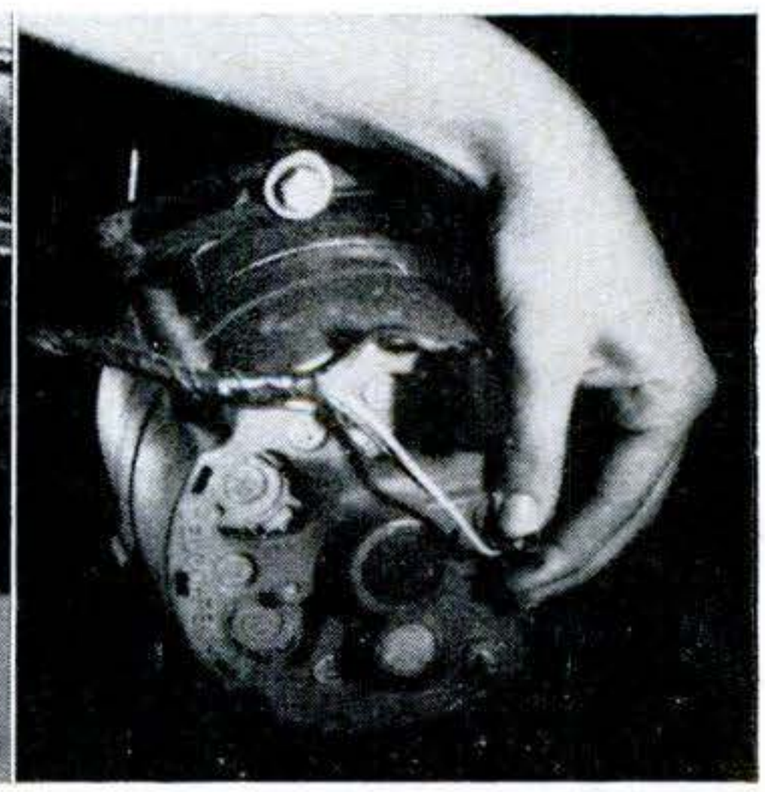


After installing the cleaned cable terminals, it's a smart idea to coat the terminal and the exposed post end with a light film of petroleum jelly. This will help to retard corrosion. Don't use chassis grease.

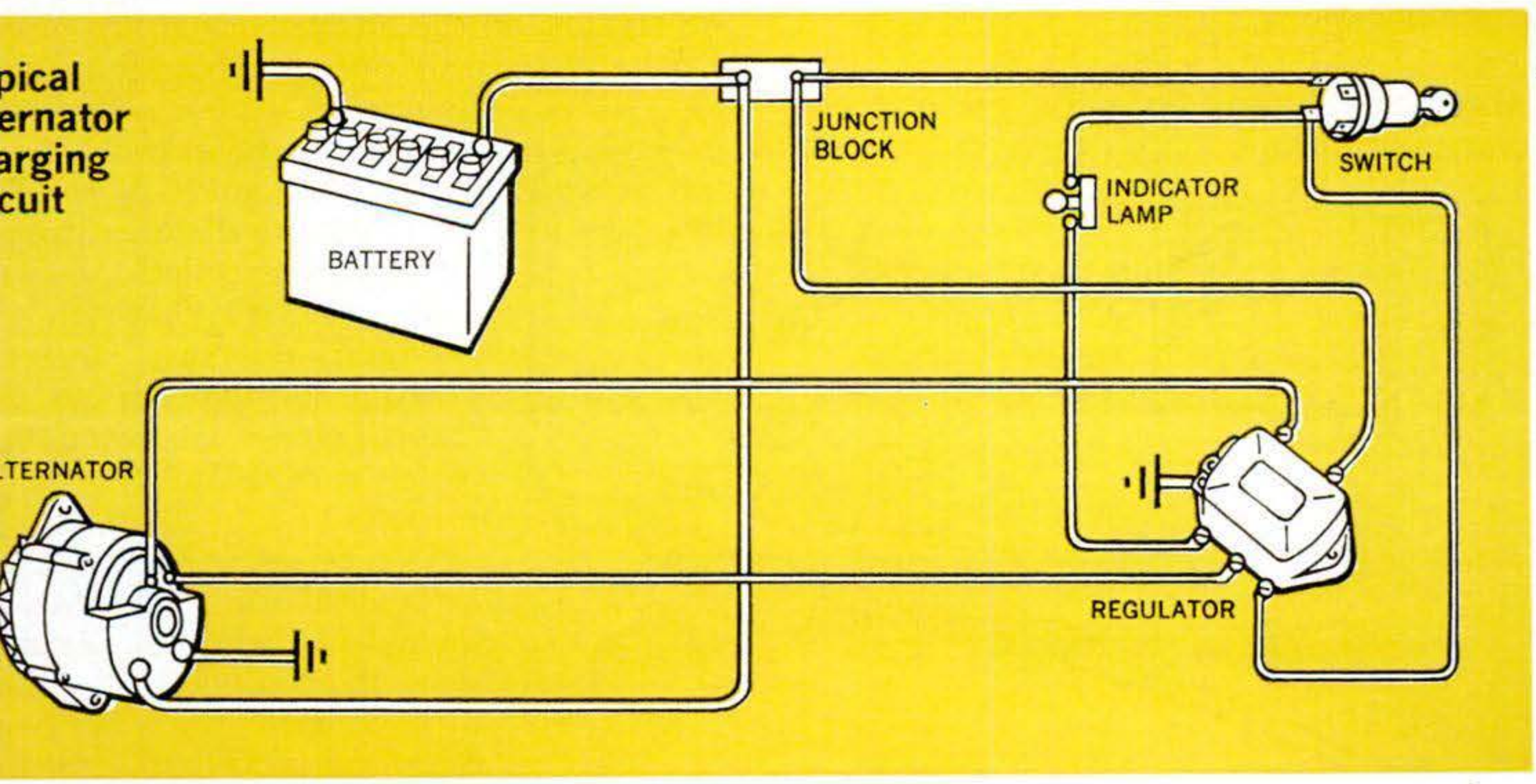


generator-equipped cars, be
e to check all wire terminal
nections at the voltage regu-
r. Connections should be clean
tight, and wires must not be
ed or damaged in any way.

Ground strap between the engine and the car frame or body must be firmly connected to make a good ground. Clean and tighten the connections as required. The ground strap should not be frayed.



Check all connections at the alternator or generator. They must be clean and tight, including the alternator plug-in. Connections for the generator are similar to those of the alternators.



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and most frequent battery service (once a month or so) is to remove the cell caps (six on a 12-volt battery, and three on a six-volt) and check the electrolyte level. It should be at least ¼ inch above the top of the battery plates. If low, add water as required. Distilled water is best, but most tap water is acceptable. Water with a high mineral content—well water, for example—should be avoided.

Your battery must be kept clean. Wipe the top with a dry cloth. Even a thin film of oil will accumulate dust and grime. Enough of this contamination will actually allow the battery to discharge itself from post-to-post via the conductive grime.

Batteries that show corrosion (green matter, which is copper sulfate) on the posts or cable terminals can be cleaned with baking soda and water.

The soda is a base and the electrolyte is an acid; consequently, *don't* let the soda get into the battery. First tighten the cell caps securely; then plug the vent holes in the caps with toothpicks.

Either make a solution of soda and water and apply it with a brush, or sprinkle soda on the corrosion and add a little water. When the soda stops foaming, flush thoroughly with clear water. Keep the flushed water off bright-metal finish. Dry the battery with a clean cloth. Caution: If your battery top has even small cracks, *do not use the soda.*

After cleaning, remove the battery-cable terminals.

Battery posts must be kept clean and bright. A dull-gray post is covered with lead oxide, which is often sufficient to form an electrical insulator between the post and clamp. A clamp-cleaning tool (about $3) does an excellent job on the posts and the inside of the clamps. If you don't have one, clean with sandpaper. Do not use emery paper around electrical connectors or conductors. Emery dust is a good conductor and can lead to a short circuit.

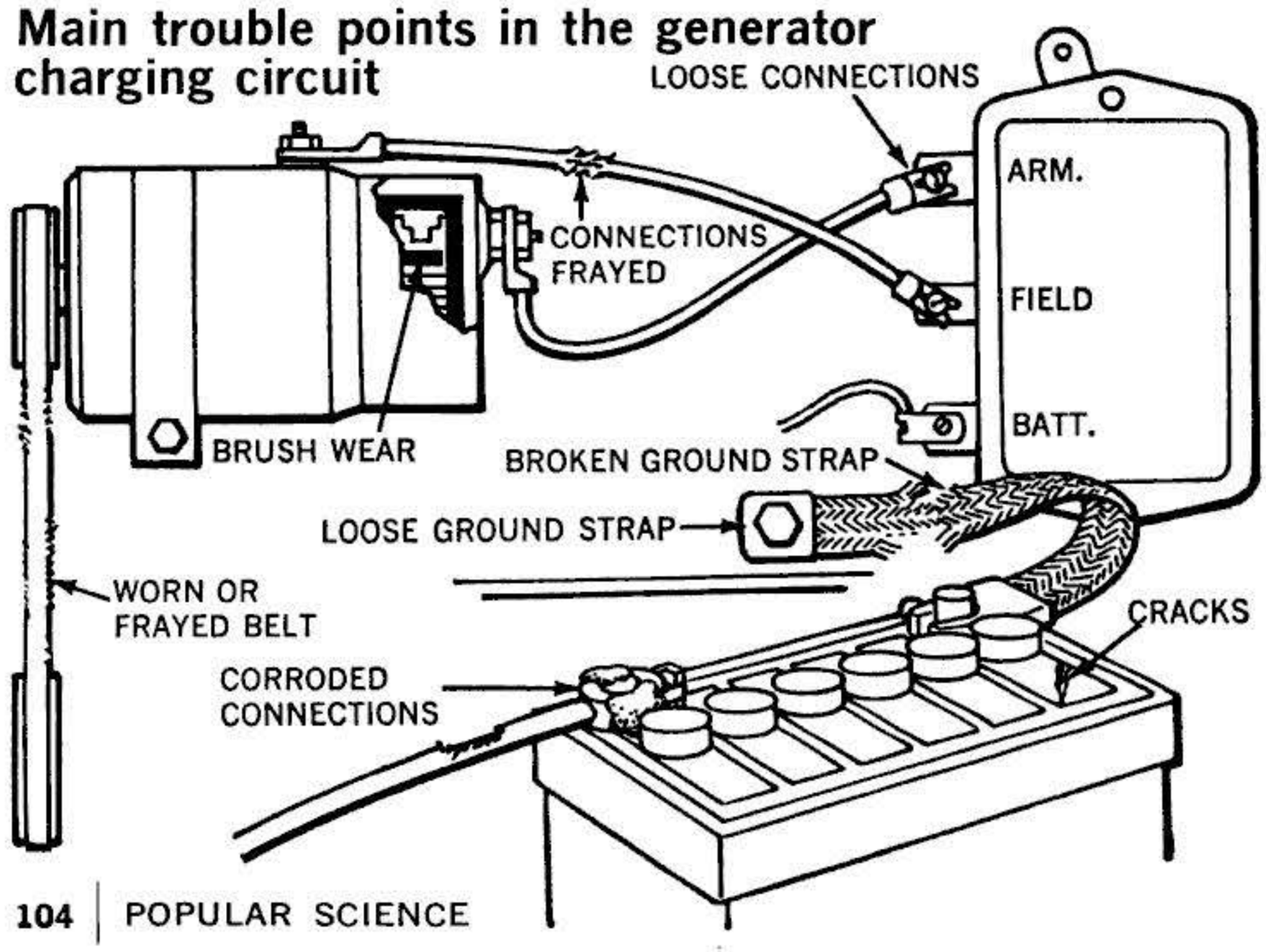
Replace cables. Make sure they are installed on the proper posts. Clean one cable at a time if there is a chance of mixup. Tighten the cable clamps securely and coat exposed posts with a light film of grease. Do not use chassis grease; it may have a metallic content that speeds up rather than retards corrosion. Petroleum jelly works fine.

Check battery hold-down bolts. Loose bolts permit the battery to bounce around in its retainer. Probably as many batteries have been shaken to death as have been worn out. Constant shaking jars active material from the plates to reduce battery capacity and short-circuit plates. Overly tight hold-down bolts can stress a battery enough to crack it. Tighten them to hold the battery snugly. Do not overtighten.

The power cable (always insulated) runs directly to a magnetic switch, except on old-model cars and other possible exceptions. The switch may be mounted on the starter, on the engine side of the firewall, or on the fender apron. Generally, if the switch is located on the starter, it is called a solenoid. A switch located some distance from the starter is called a relay. A solenoid-relay switch is mounted on the starter. Turning the ignition key to "Start" closes the magnetic switch to activate the starter motor.

Two types of starters are in general use. One has a solenoid to bring the starter gear in contact with the flywheel gear; the other has Bendix drive where a spiral

Main trouble points in the generator charging circuit



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l check them out

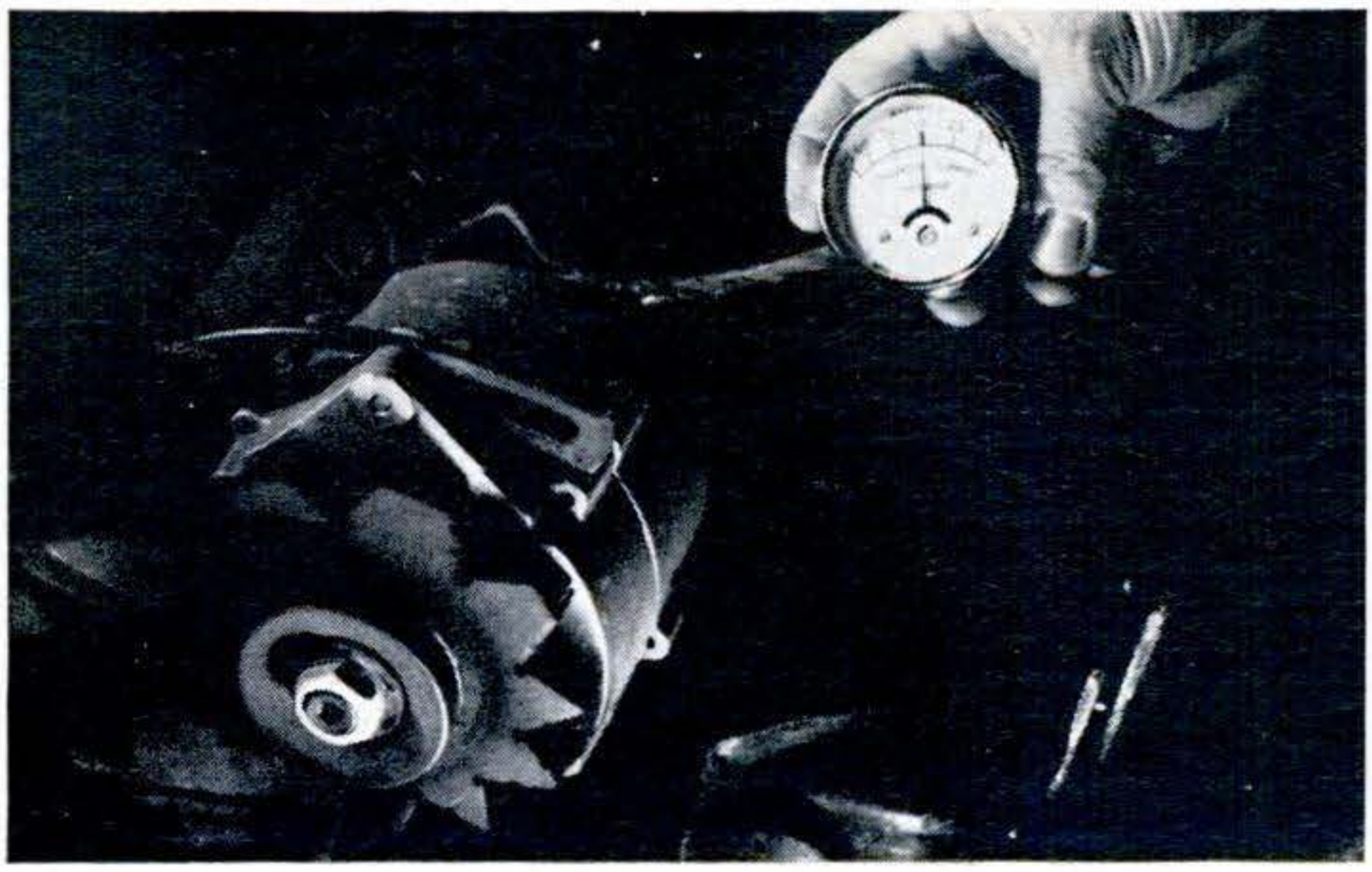
haft moves the starter gear xially to bring it in mesh vith the flywheel gear. Most 7-8s have solenoid engage- nent and overrunning lutches, while economy en- ines tend to use Bendix rive, where the spiral shaft nscrews itself when fly- vheel speed exceeds starter peed. Late-model units (in 2-volt systems) often have bypass ignition resistor in he starter solenoid.

All electrical connections hould be clean and tight t the solenoid. Watch for plastic end aps containing terminal posts. Do not vertighten; it may crack the cap assem- ly.

Trouble-shooting a starter. If the starter vorks but action is sluggish, it may be lrawing more current than the specs call or. Starter-motor current draw can be hecked with a high-reading ammeter con- nected in series between the battery and he starter. Current draw around 200 mps is usually too much, although on a rigid zero morning normal current draw nay exceed this figure; it takes a lot of urrent to crank a very cold engine.

Excessive current draw in moderate veather or with a warm engine can mean number of things: bad starter bearings llowing the armature to rub against the elds, bent shaft, broken starter housing, ad starter drive or flywheel gear, etc. Make a starter free-running test to see vhat it takes to operate the starter with- ut cranking the engine. This usually nvolves removing the starter from the ngine. If the free-running test is okay, xcessive current draw is due to engine ondition. If not, overhaul or replace the tarter.

In occasional cases, a hot engine may e very difficult to turn over. This can be ue to incandescent particles in the com- ustion chambers, which temporarily advance" timing so far that the engine icks back against the starter. Allowing ne engine to cool for a couple of minutes a temporary cure, although some con- itions call for cleaning the combustion hambers. A chemical treatment or a



Position meter over output wire. No mechanical connections are needed. Accuracy is sufficient to indicate charging-circuit output.

change in gasoline sometimes solves the problem.

Ground straps. Today's engines are insulated from the frame by heavy rubber mounts. To insure a good ground between engine and frame, ground straps (braided, noninsulated wire) are used. Connection for these straps must be clean and tight. Paint can be a problem here.

Battery test. A battery check using only a hydrometer is rarely effective in determining battery condition. A hydrometer is simply a syringe-type instrument that checks the specific gravity of the electrolyte. The higher the specific gravity, the higher the battery's state of charge. The hydrometer draws out electrolyte from the battery cells into a glass tube. A calibrated weight floats in the electrolyte at a height proportional to the specific gravity of the electrolyte.

Readings are taken off the floating weight at the top of the electrolyte. A reading of 1.300 or slightly higher is considered a full charge. A reading of 1.215 or lower is an indication that the battery needs charging. The state of charge has nothing to do with battery capacity. A fully charged battery of low capacity can do a poor job of cranking an engine. To do a thorough and accurate job of testing battery condition, special equipment is needed. This is a job for your local serviceman, especially on a modern, sealed-top battery.

Charging rate. The regulator, working with battery voltage, controls charging-

[*Continued on page 204*]

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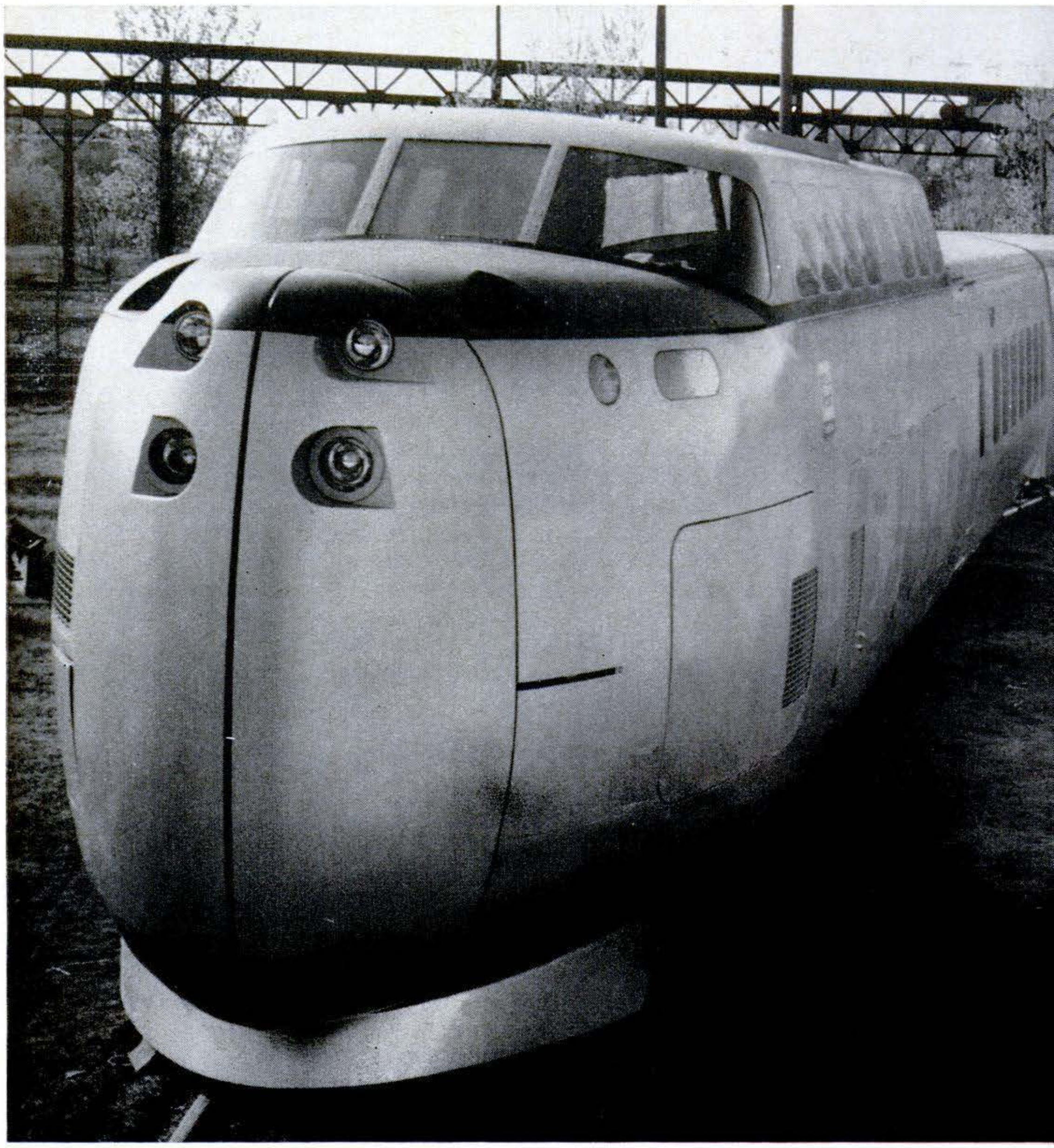
Come Ride on Rails

With service and interiors like airliners, new trains will slash time schedules at intermediate distances to woo you from the crowded road and the airway

Any one of these days now, you'll be able to board a high-speed common-carrier transport, settle back in a soft seat, and be served meals on a tray that folded out from the back of the seat ahead of you—while streaking along at truly phenomenal speeds.

In an airplane? No, that's old hat; in

TurboTrain has entrance doors in center of coaches and eight gas turbines for power—six t



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t 100 m.p.h.! By DEVON FRANCIS

rain whizzing between New York and shington, on some stretches at 110 es an hour.

n a few months you can ride another e of high-speed train—strikingly dif- ent—between Boston and New York, between Montreal and Toronto.

ll aboard! You've never experienced this kind of rail transit. These trains can whoosh from a dead stop to 125 m.p.h. in less than two minutes. Vibration and sway are low. The coaches are full of catnip to entice you from superhighways and airlines: soft carpeting, telephone service, carry-on luggage racks, personal seat lighting, curtained windows of tinted glass, hostesses, and taped music.

Average speed? That depends. While the railroads involved will confine themselves to 100 to 110 m.p.h. in spurts, the Pennsylvania averages close to 80 on the 226 miles between New York and Washington. That's 20 m.p.h. faster than its standard trains. The New Haven plans to average 72 m.p.h. on the 216 miles between Boston and New York; and the Canadian National, 85 for the 335 miles between Montreal and Toronto.

That's just for now. The Pennsy's ultimate goal is a 115-m.p.h. average, New York to Washington. Within two years, constant speeds of 125 may be common; the designers are talking confidently of 150 by 1970. Limiting factors now are

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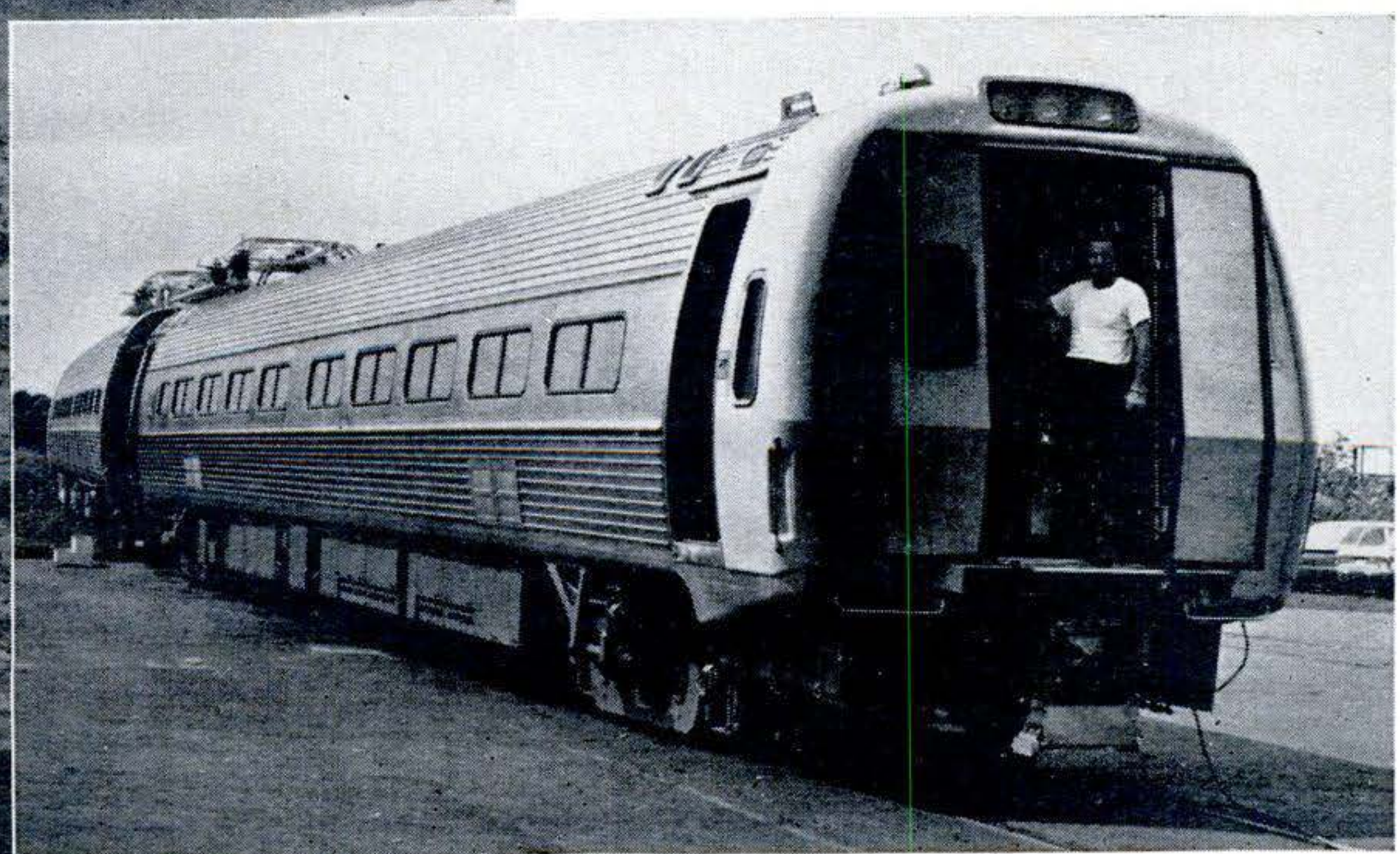
n and two to supply light and heat.



Another type of superspeed train is made up of electrically driven, self-powered coaches. Like Turbo-Train, it is capable of 160 m.p.h. Rails welded together in lengths of 1,400 feet, instead of standard 39, do away with most clicking. Both types of cars have six more inches of shoulder room than old ones.

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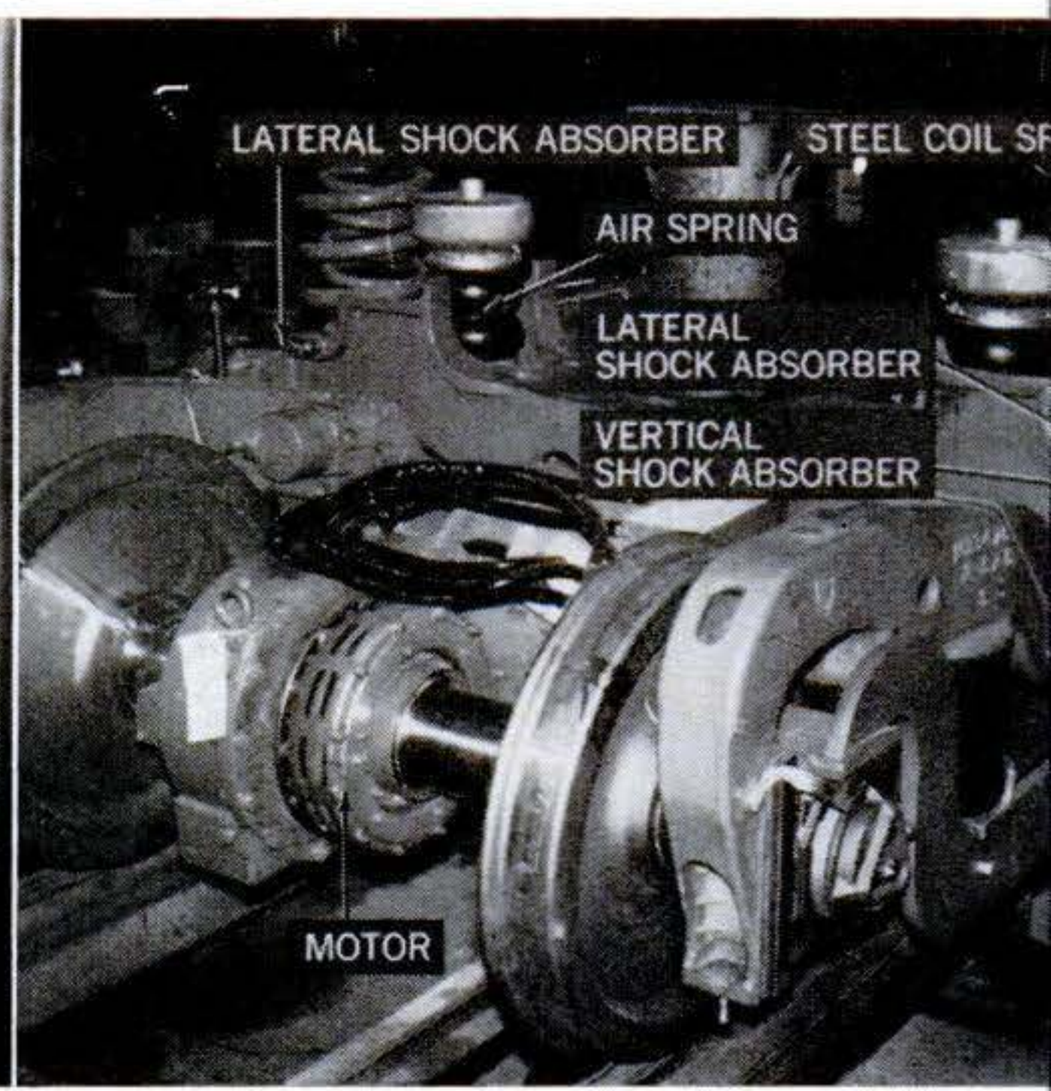
The new look in trains: supersoft springing, airliner elegance

Pennsy power-control handle sets speed which is maintained automatically—the current input to four traction motors per car is set by a feedback from axles, like an automobile's constant-speed system.



Coil and air springs give soft ride. Each motor h output of 640 hp., or 2,560 per car, at 100 m.p Braking is "dynamic"—motors become generato down to 30 m.p.h., when they blend with air brake

roadbed and curves. The trains themselves can do 160 without panting.

The railroads are bent on swiping a lot of airline patronage. "Put it this way," said an official of United Aircraft (now in the train business!). "Counting the time it takes to get to and from airports, board a plane, wait for takeoff, land, and claim your luggage, our new train will beat plane time from Hartford to New York (109 miles) even if we assume the plane's actual flight time is zero. Soon we'll beat zero flight time from Boston to New York."

Ha! you say, that's that Northeast Corridor thing [PS, Jan. '66]. What's that got to do with the rest of the country? Just this: The Middle West and Far West are as actively interested in high-speed trains as the Eastern Seaboard. A speed of 150 m.p.h. between Los Angeles and San Francisco would cut a jet plane's advantage to less than an hour—downtown to downtown—and that between Chicago to St. Louis to 10 minutes.

Superspeed trains also could relieve big-city-to-suburbia auto-traffic congestion at the rush hour. The railroads, nudged into the high-speed experiment by the federal government's mint-new Department of Transportation, point out that one train of eight to 10 coaches can handle as many people as a jam-packed mile of superhighway three lanes wid Indeed, San Francisco in two years w have trains designed to do just that.

There is precedent for train compe tion with airliners—the Tokyo-Osa super-express, making the 320-mile ru at an average of 101 m.p.h. (with tw stops!), has captured three-fourths of t airline business between the two cities.

New kind of iron horse. The two U. high-speed trains are as different as da and night. The Pennsy's Budd-bu stainless-steel cars, electrically self-pr pelled—needing no locomotive—are t same length as standard coaches, 85 fe but are six inches wider (10½ feet Overall height is more than a foot le than the standard 13½. It's in weig and power, though, that the new ca begin getting spectacular. Each of t Pennsy cars has traction motors addi up to 2,560 horsepower as against old cars' 620. For their 88.8 tons each, t new cars have 17.1 horsepower per to The old ones have only 10.6.

The New Haven's and Canadian N tional's United Aircraft seven-car Turb Trains are far more revolutionary. Pr pelled by the same kind of gas turbi that brought Parnelli Jones close to vi tory in this year's 500, they weigh on 150 tons—a bit more than 21 tons p car. This power plant is the "free tu

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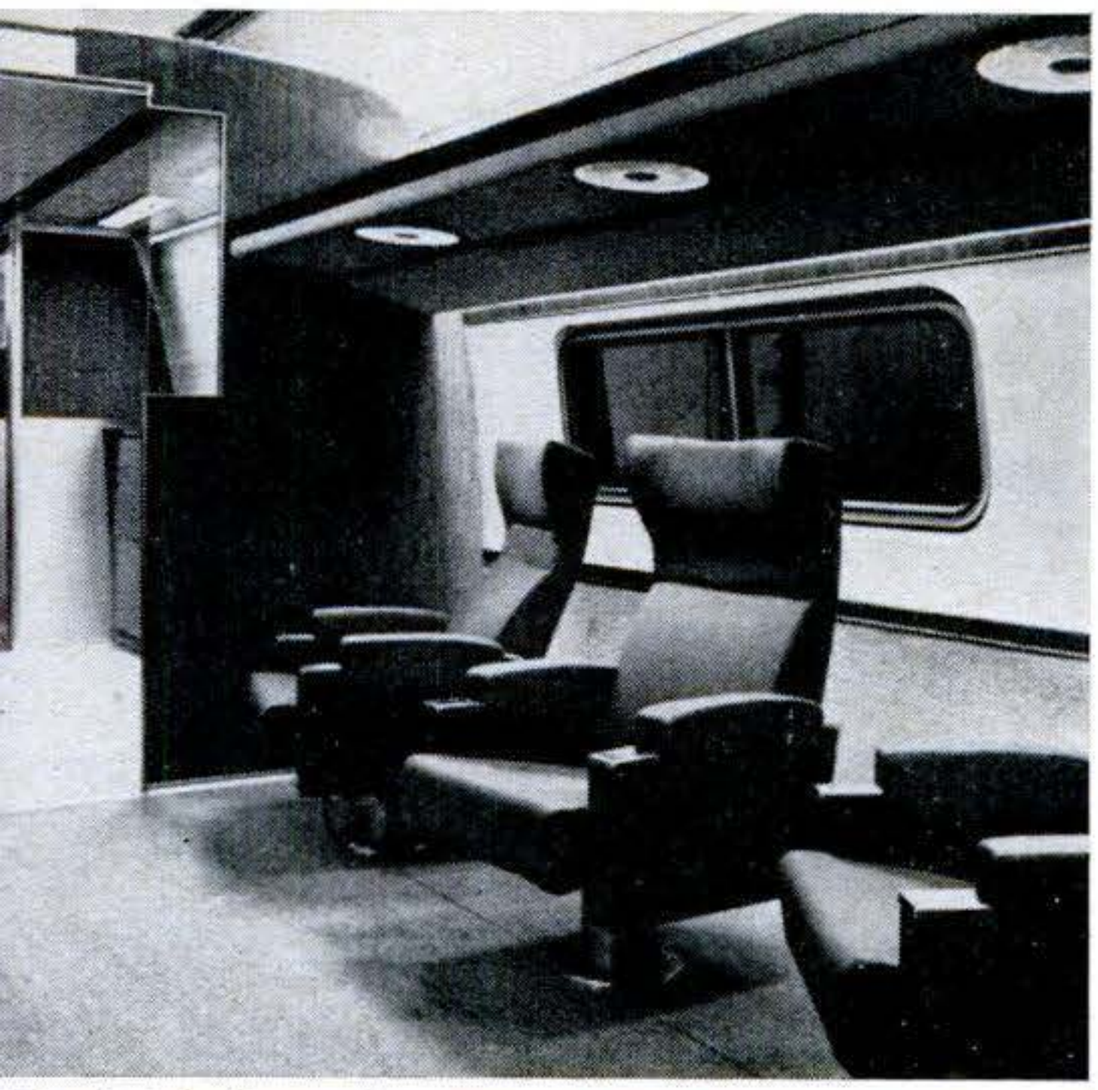


Plush interiors of extra-fare coaches include carpeting, dial telephones to anywhere, contour chairs. Budd cars are of curved-side stainless steel; United Aircraft cars are lightweight aluminum.

bine" Chrysler used in 50 experimental automobiles in 1963.

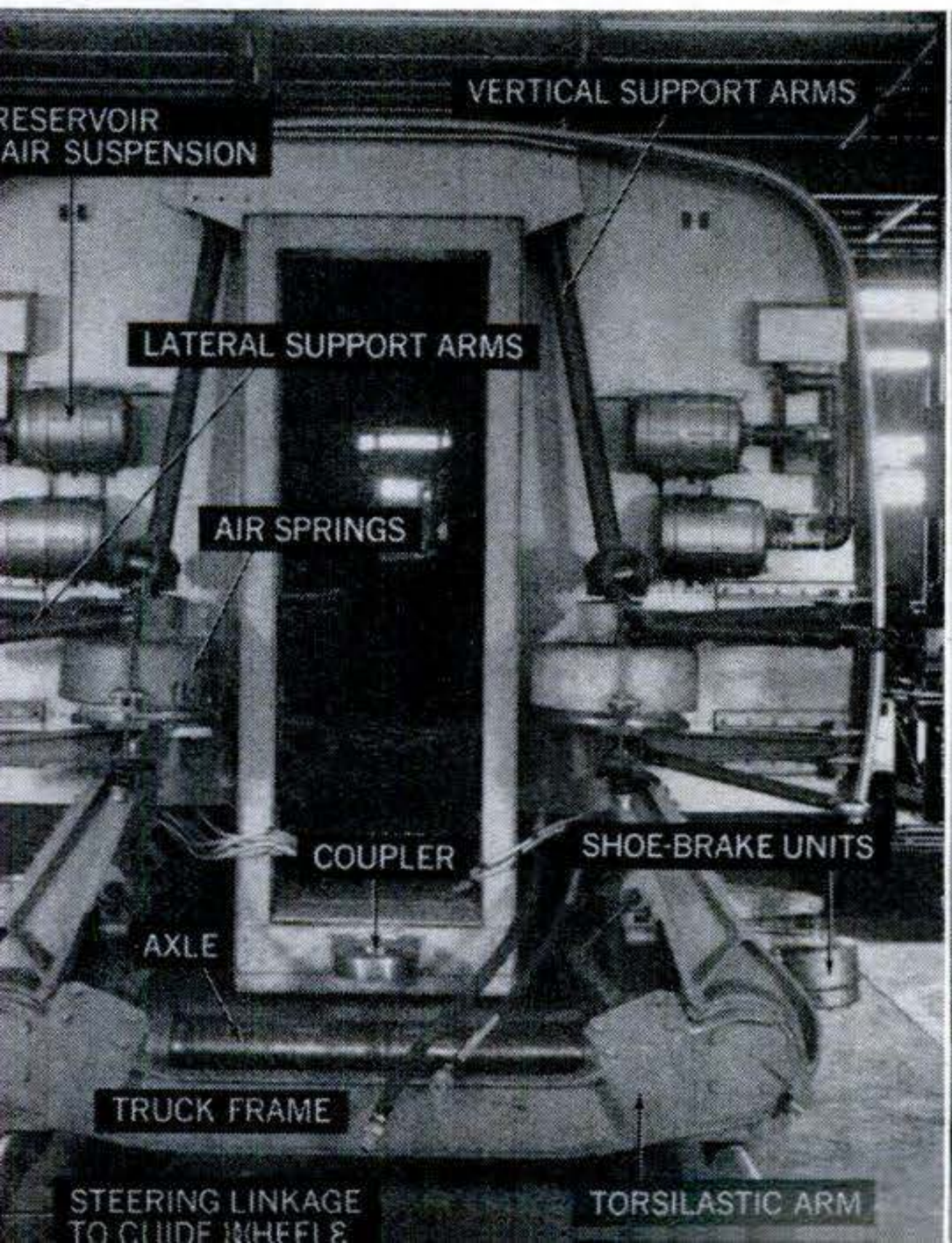
Gas turbines in trains are nothing new. What is new is the transmission of power to the wheels. Heretofore, train turbines converted their torque through electric generators or hydraulic transmissions. The TurboTrains employ direct drive from the free turbine to the wheels through a gearbox. These trains are like utility outfielders—they can use electric third-rail propulsion. And the turbines don't pollute the air.

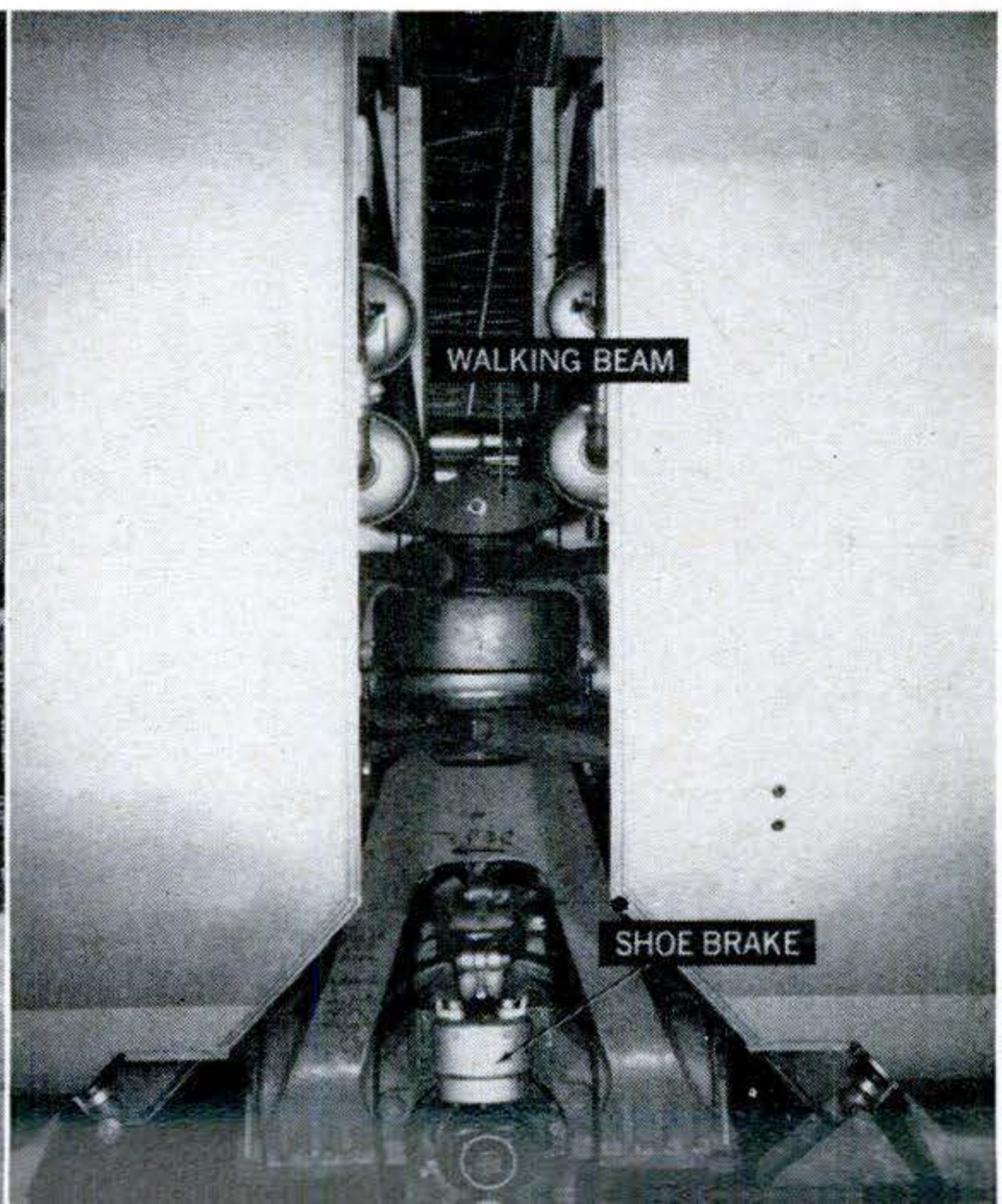
Taking the curves. The most stunning news on the TurboTrains is the suspension. Cars hang from an overhead anchorage. When they take a turn, they swing outward. Your seat banks gently, like an airliner's. The weight transfer—mark this—lets the TurboTrain take curves at a 40-percent higher speed than conventional trains. This eliminates the need for what railroad men call super-elevation of the track—added bank in the roadbed. That's good because there's a limit to super-elevation beyond which freight trains cannot stay on the track.

The TurboTrains have other striking innovations. Of the seven passenger cars that will make up a train, the five in the middle will have only six axles, between cars, as against a conventional 20. The powered coaches, on the ends, will have four each. PS

Cars hang from overhead anchorage like a Ferris-wheel car

Exposed coach end of New Haven (and Canadian National) train shows unique suspension. As against standard railway car's 85-foot length, unpowered TurboTrain coaches are only 56 feet long and powered ones only 73. Yet a seven-car train will accommodate 300 passengers with ample seating room, compared with 320 in seven conventional cars. Reason: There are no vestibules, and couplings are flush. Aisle is one long corridor, from train's front to rear. Height of coach floor above rails is 32 inches instead of standard 50. A sort of turnbuckle (below) guides wheels around curves to prevent shimmy.





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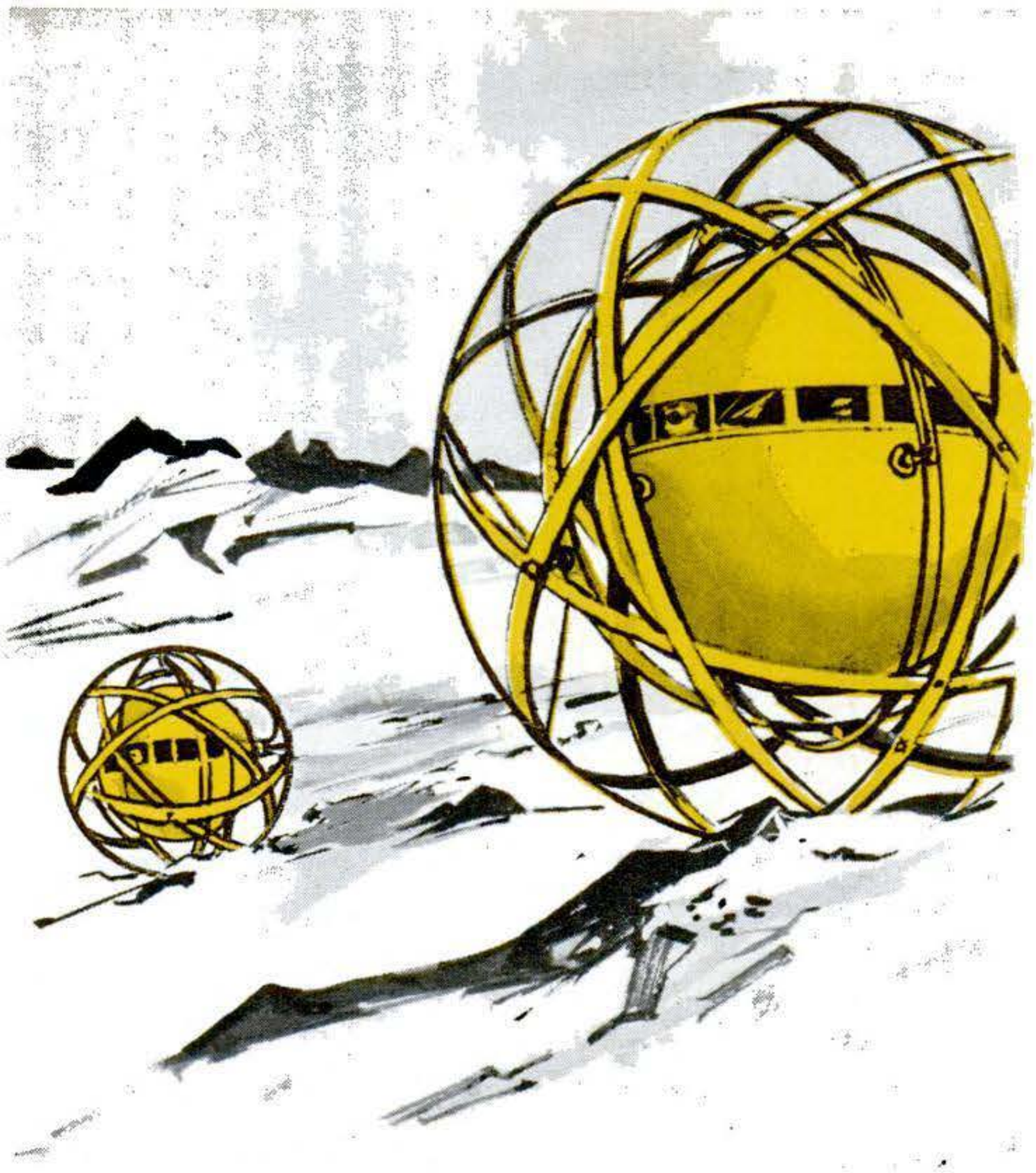
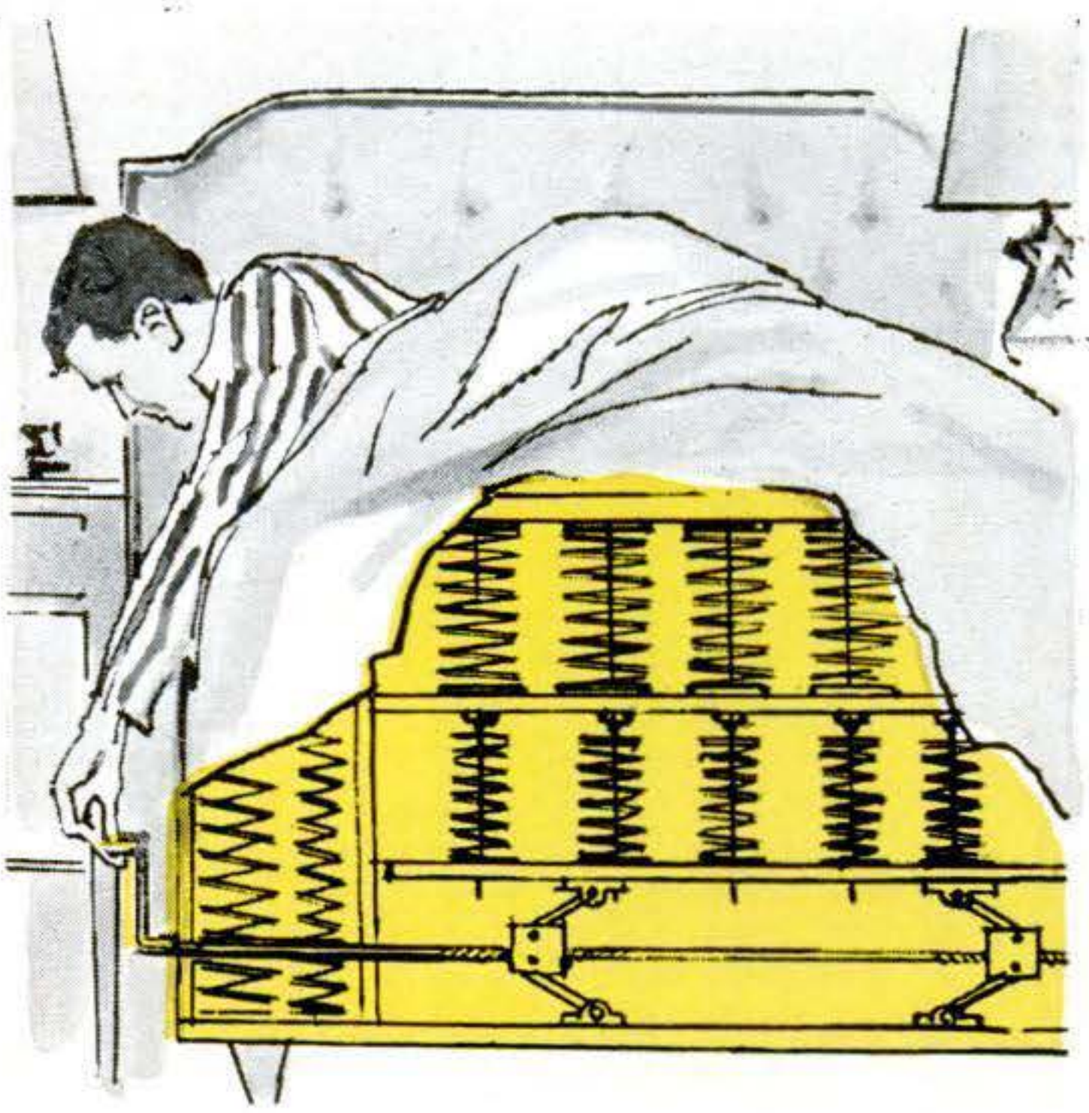


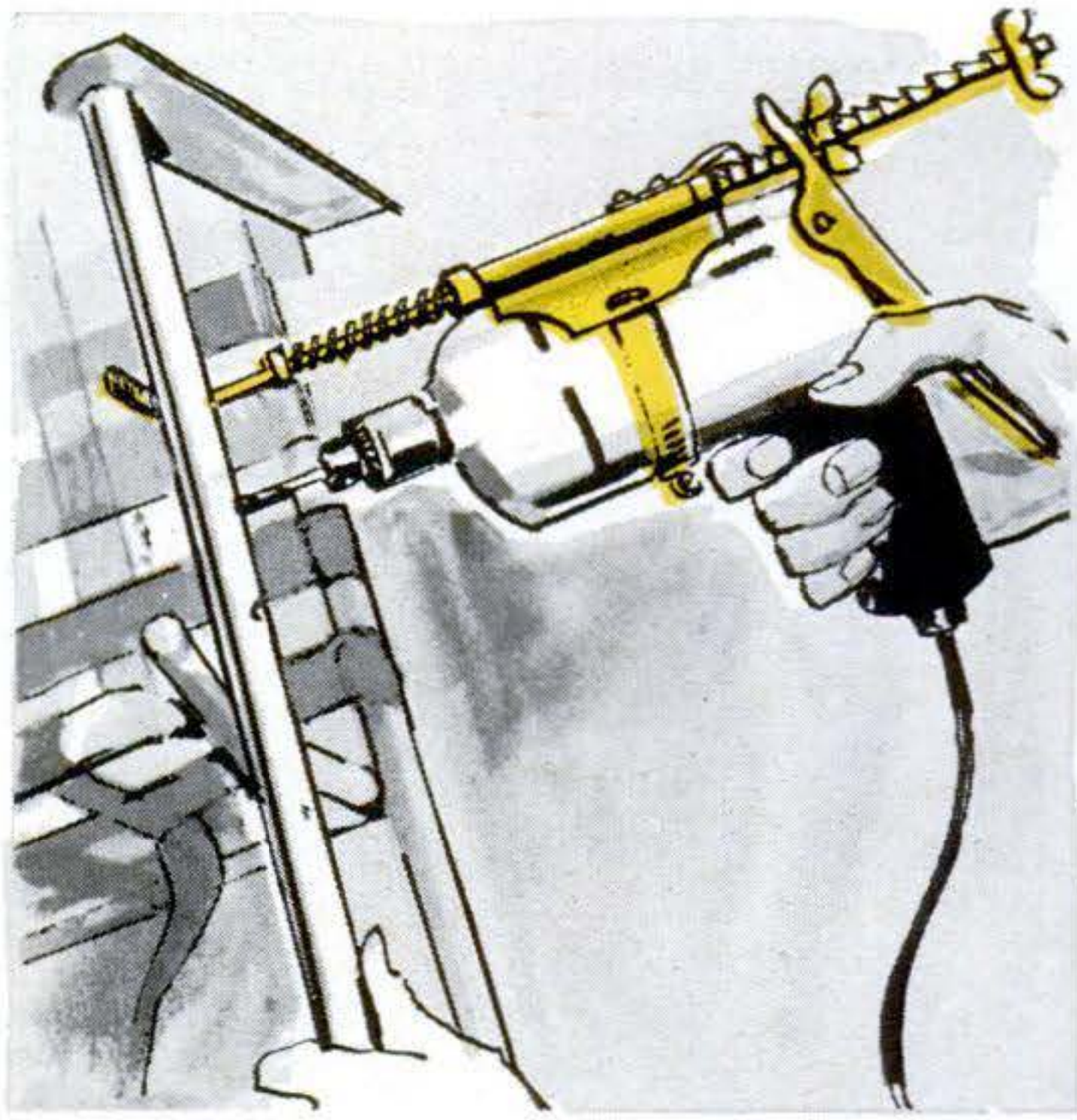
New Ideas from the Inventors

DRAWINGS BY WILLIAM CASTIMO

Cab rides inside "wheels." Very rough terrain—such as an icecap or the surface o the moon—might be traversed more easily by this giant bal made up of a number of hoops The cabin of the recently pat ented vehicle would be mount ed on gimbals on crossed axes to remain upright as the bal rolled. Outer rims could be mechanically driven, or the vehicle could be powered by steerable rockets or jets.



Mattress adjusts for firmness. You could be sure your bed (in a guest room or a motel or hotel) would always be exactly as soft or as firm as you like it with this mattress. A plate that could be moved up or down by a motor or hand crank would compress or extend the upper springs, stiffening or softening them. The change wouldn't alter the size of the mattress or the fit of the sheets.



Jig turns drill into press. You could bring an electric drill to any job and use it in any position by attaching this fitting. A saddle would clamp to the drill body, hold a notched, spring-loaded rod parallel to the chuck axis. You'd grip the work on a serrated plate at the tip, advance the notched rod from the other end by pressing a handle lever. A wing-nut would set the desired drilling depth.

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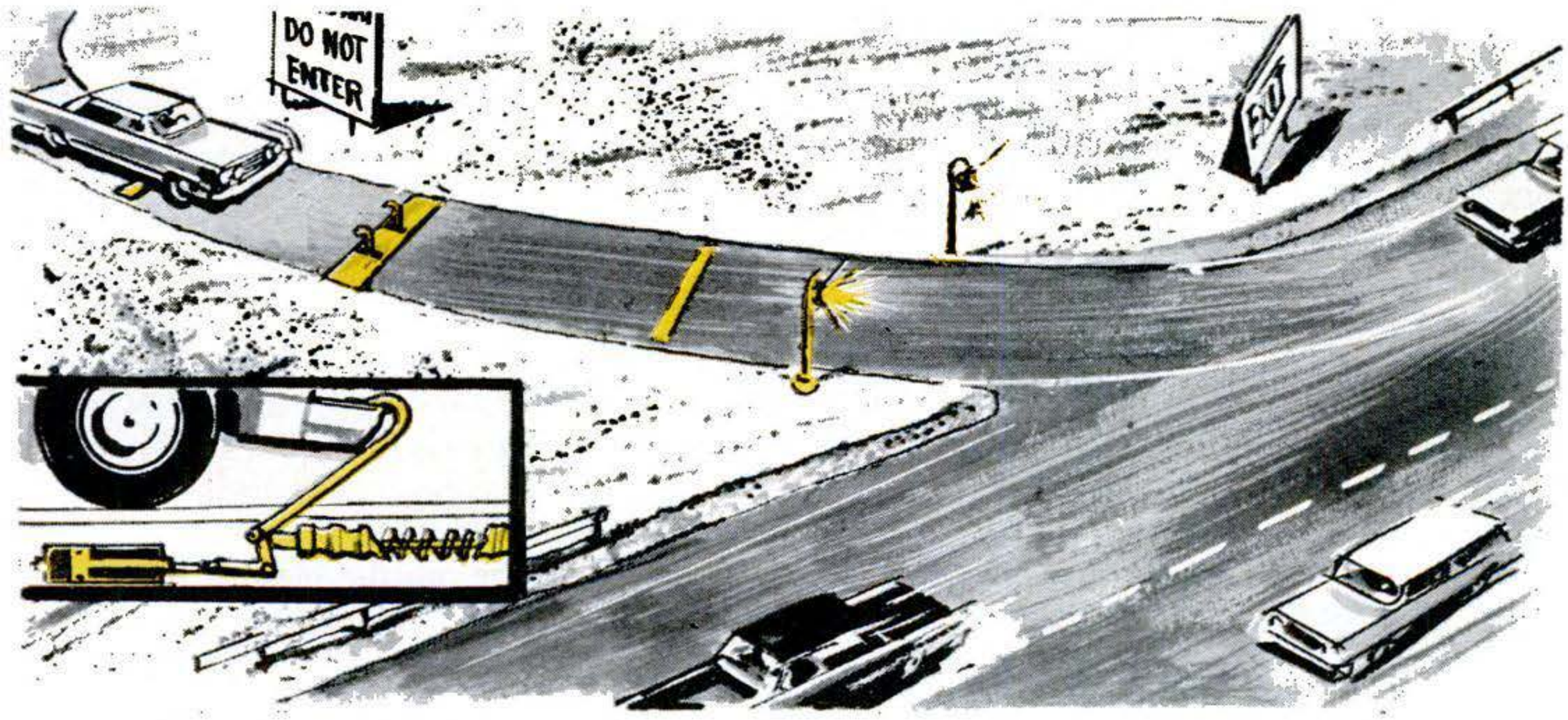
Shower head prevents scalds. A temperature-sensitive valve inside this shower head might prevent the sometimes dangerous overheating that can happen when cold water is drawn off somewhere else in the house. The valve would reduce the flow to a trickle when temperature rose beyond a preset limit, restore the spray when temperature fell.

Motorized brush speeds scouring. Snap-fastened to a holder on this motor shaft, a stiff brush or scouring pad would zip through caked grease and grime to clean pots and pans. The sealed, submersible-type motor would work safely under water; it would be geared down for high torque, and could be used for mixing and polishing jobs.



Guard stops wrong-way car. A car that entered this highway by an exit ramp would trigger an arresting bar similar to those used to stop jet planes on a flight deck The bumper-gripping arrestor would rise from the pavement ahead of the wrong-way car and snub it to a gradual stop. Meanwhile, warning flashers would alert right-way drivers.

The following patents have been issued on these inventions: **Hoop vehicle**—*No. 3,327,801 to A. A. Ezra, Littleton, Colo.;* **Adjustable mattress**—*No. 3,252,170 to J. R. Frye, Lakeside, Mont.;* **Drill Press**—*No. 3,250,153 to E. W. Purkey, Oroville, Calif.;* **Scald preventer**—*No. 3,263,926 to R. W. Couffer, Deerfield, Ill., and J. Algino, Chicago;* **Scouring motor**—*No. 3,319,093 to E. G. Abdul, NYC;* **Car arrestor**—*No. 3,266,013 to L. V. B. Schmidt, Los Angeles.*

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington, D. C. 20231, at 50 cents each. To write to an inventor, if the address above is insufficient, address him (by name and patent number) in care of the Commissioner of Patents.

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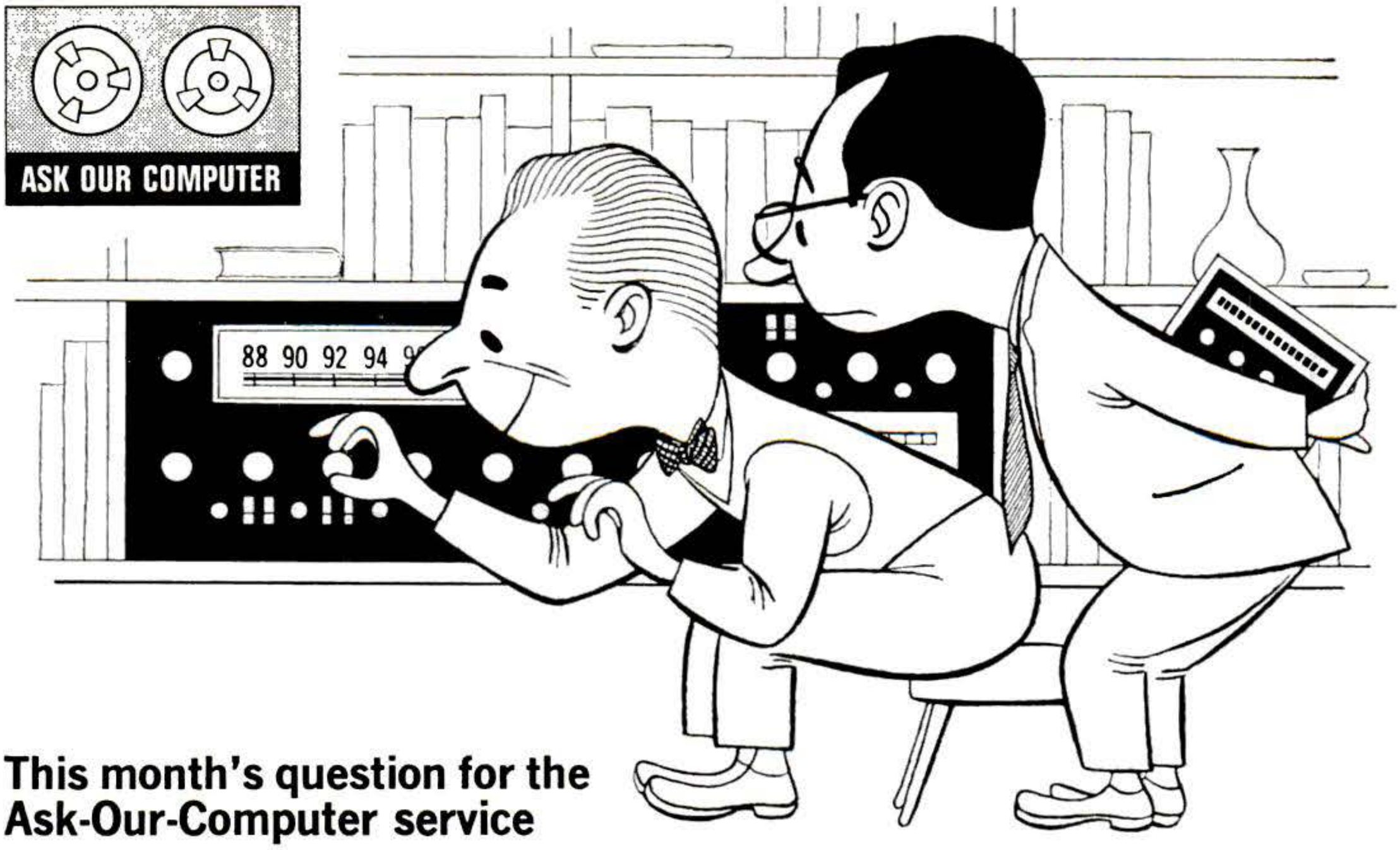

This month's question for the Ask-Our-Computer service

What's the Perfect Stereo Receiver for Me?

Up in the air over stereo? Let our computer find the receiver that meets your needs

The stereo receiver—an integrated unit containing a stereo FM tuner, stereo preamplifier, and stereo amplifier on a single chassis—is rapidly on its way toward becoming the fastest-selling audio component. The latest all-solid-state units prove that combining the three traditionally independent units doesn't detract in anyway from performance or versatility.

Chances are that you have thought of adding a stereo receiver to your sound system. But which one? There are dozens of manufacturers and scores of models to select from. One look at the variety on the dealer's shelf, and you can understand why it makes sense to have a computer help when you choose.

This month, PS's giant electronic computer is programed to do just that. We've fed a mountain of data into the machine --the facts and figures about all of the popular stereo high-fidelity receivers.

Mail us a stamped, self-addressed envelope, and we will send you back a detailed questionnaire that asks for pertinent information about your stereo-receiver requirements.

What kind of speakers do you have (or plan to purchase)? How big a room will the sound system be used in? How much do you wish to spend? These are just a few of the questions.

When you return the completed questionnaire to us, along with a $1 service charge, our computer operators will feed the data it contains into the machine. In a matter of seconds, the computer will compare your requirements with the available receivers and will print out a list that tells you which model or models come closest to meeting your needs and pocketbook. You will receive the actual list produced by the computer.

Send your stamped, self-addressed envelope (legal size, please) to Ask-Our-Computer, Program #6, POPULAR SCIENCE, 355 Lexington Ave., NYC, 10017.

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GIANT WINTER WORKSHOP SECTION

begins here

WINTER WORKSHOP

79

GOOD IDEAS!

Watch for this GOOD-IDEA symbol in the special articles on the following pages

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Two Unusual Gifts 2

5 Repair Tips for Home Owners 5

Armrest for Your Car 1

Easy Way to Make Toy Building Logs 1

Toy Steam Engine Has a Secret 1

How to Create a High-Rise Bike 1

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7 Shop Tricks Others Have Used 7

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Canoe Built from Siding 1

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7 Good Things to Make for Your Shop 7

Christmas-Tree Lights That Dance 1

Shop Talk 6

Buffet? Dining Table? Here Are Both in One 1

TOTAL GOOD IDEAS: 79

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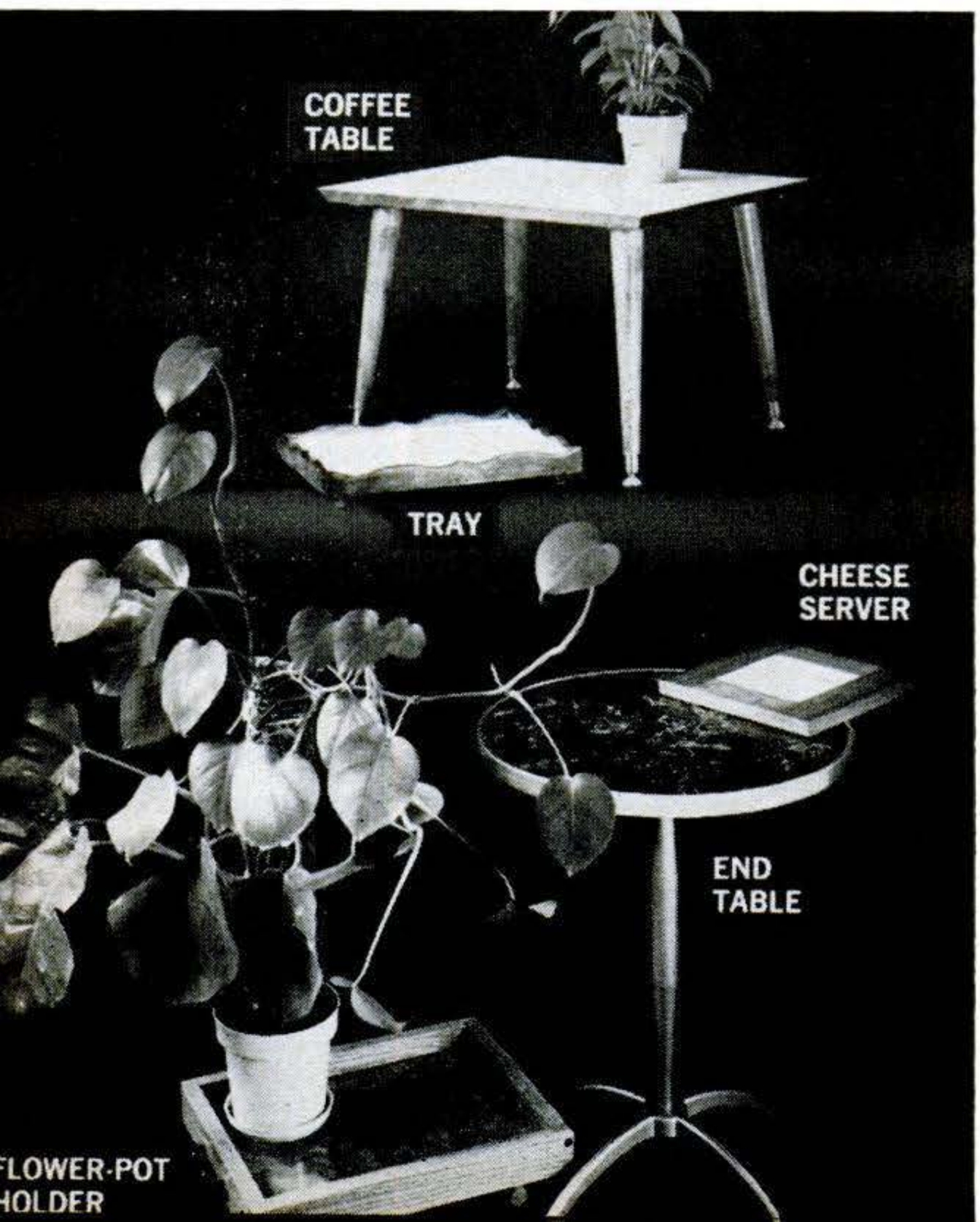
What You Can Make wit



There's treasure—in project material—in just about any woodworking shop in your town: the stack of cutouts left over when sinks were installed in counter tops. They come in a variety of sizes and shapes, and at bargain rates.

These cutouts can give you a head start on all kinds of projects. The top is already finished—a durable plastic laminate is bonded to a backing of ¾″ plywood or particle board (usually of slightly less thickness). Your main job is finishing off the edges.

You'll find cutouts most suitable for use where you want the same qualities you have in a counter top—a surface that's waterproof and resistant to burns and scratches. If your project is for your kitchen, you may find a cutout that matches your counter top. Take your ruler along to be sure you get a cutout

These started as counter-top cutouts (photo above), leftovers from a local cabinet shop. They're inexpensive and they give you a head start on all kinds of projects.

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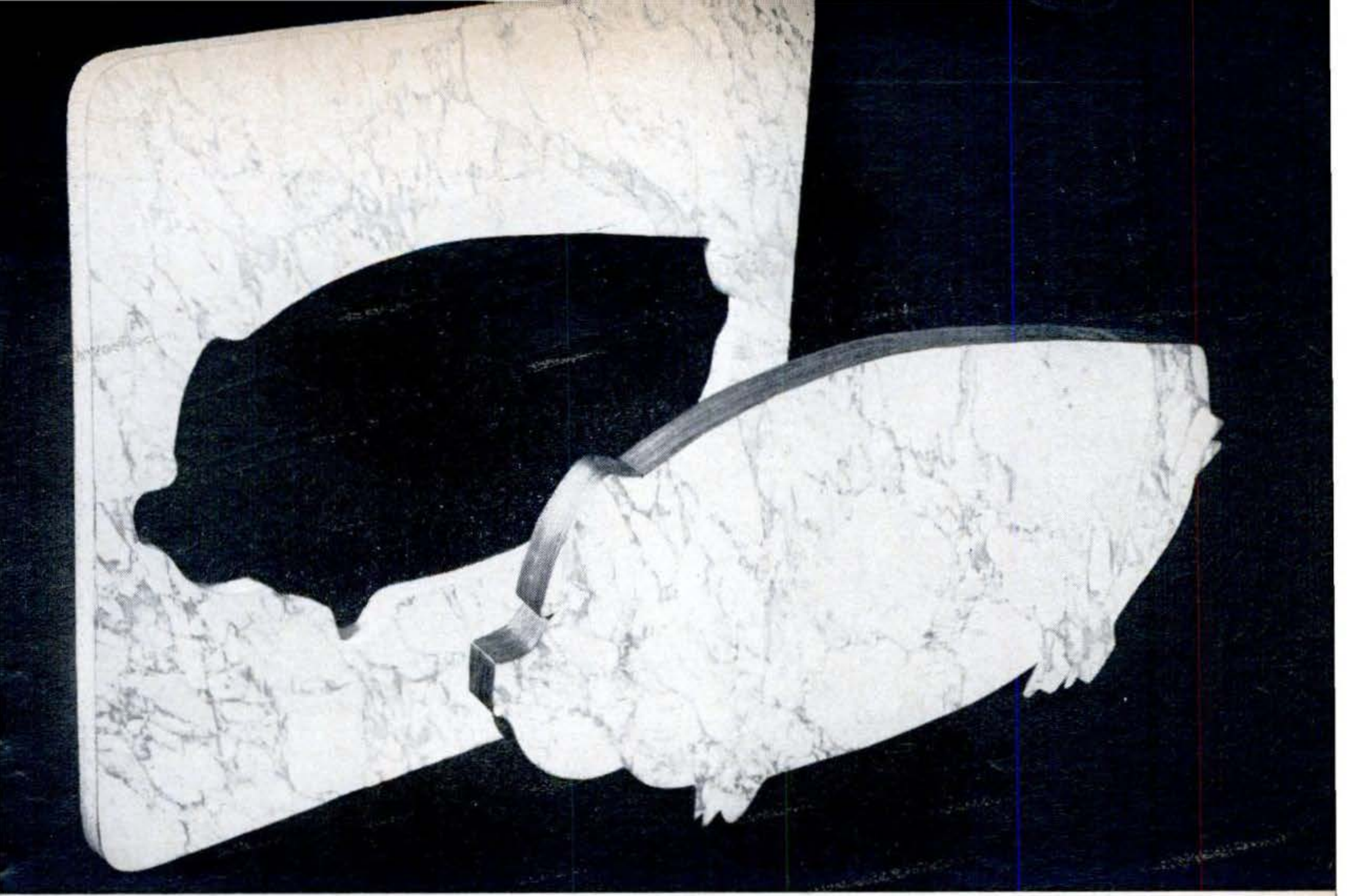

ounter-Top Cutouts

By HARRY WICKS

ig enough for the item you're planning. In most cabinet shops, cutouts are nade with a router and template. This neans the corners will be rounded, the dges true. Since the outside perimeter s square, it's a snap to cut the piece to ize on a bench or radial saw. A comination blade cuts the material fine, but if you own a carbide-tipped blade, use it. Plastic laminate will not ruin an ordinary blade, but it will dull it.

Screws turned into the underside should not measure more than 5/8". You can use screws that come with factory-made legs; the plate takes up about 1/8", so they won't come through the top.

Continued

Porker Cutting Board

WINTER WORKSHOP IDEA

Porker cutting board can be made in 30 minutes (leftover material makes a cheese server). Draw the design on the back of the cutout. Cut with a saber saw, using a fine-tooth metal-cutting blade to prevent surface chips. Sand the edge smooth, apply wood tape with waterproof glue, and, when dry, rub with salad oil. Attach two eye hooks to hang the board.

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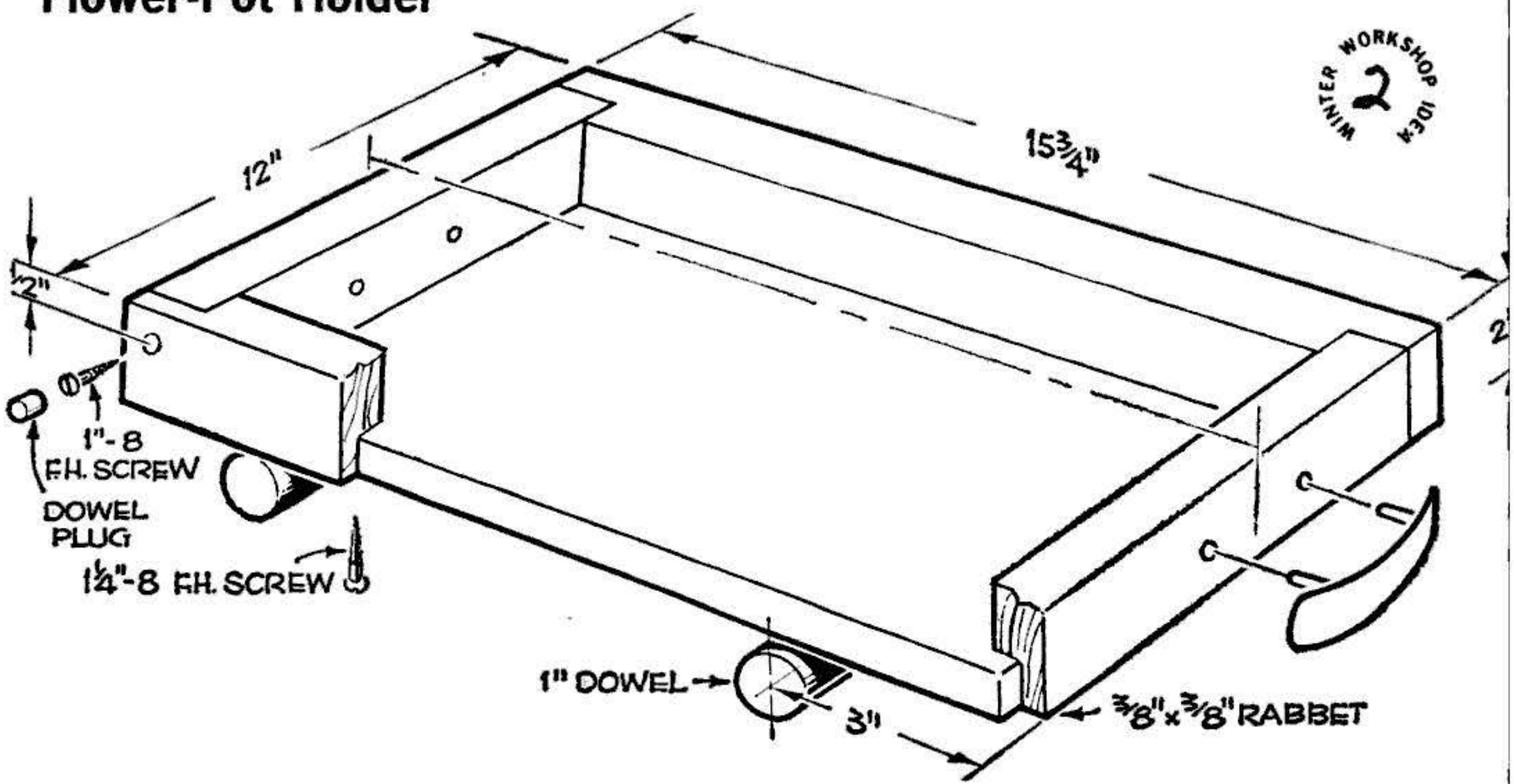
Flower-Pot Holder

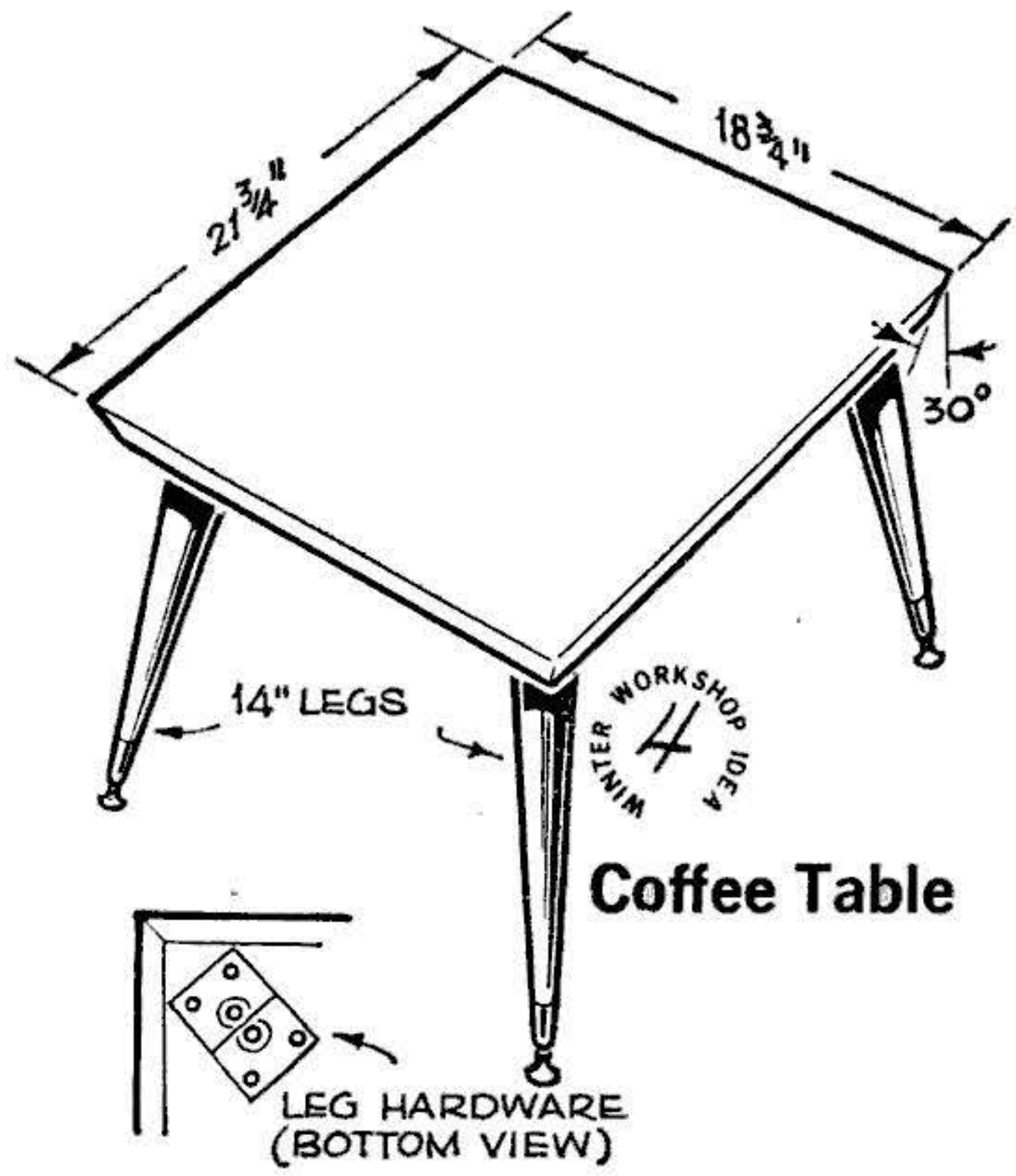


All sides of frame are rabbeted on bottom edges to receive the cutout. Attach it with waterproof glue and screws. Fasten the 1" dowel "legs" with countersunk 1¼" flathead screws. Frame shown is made of oak, with Rennaissance handles by rock. For contrast, walnut dowel plugs were us the corners. Wood was finished with two coa shellac. For outdoor use, finish with exterior va

Finishing the edges. If you want to stick to a natural wood finish, one of the simplest is wood tape, held on with waterproof glue. Outside corner guard, with one side ripped narrower than the other, works fine, too. This is particula ly good on trays; the vertical offset kee objects from sliding off. If you want flush top, use lattice.

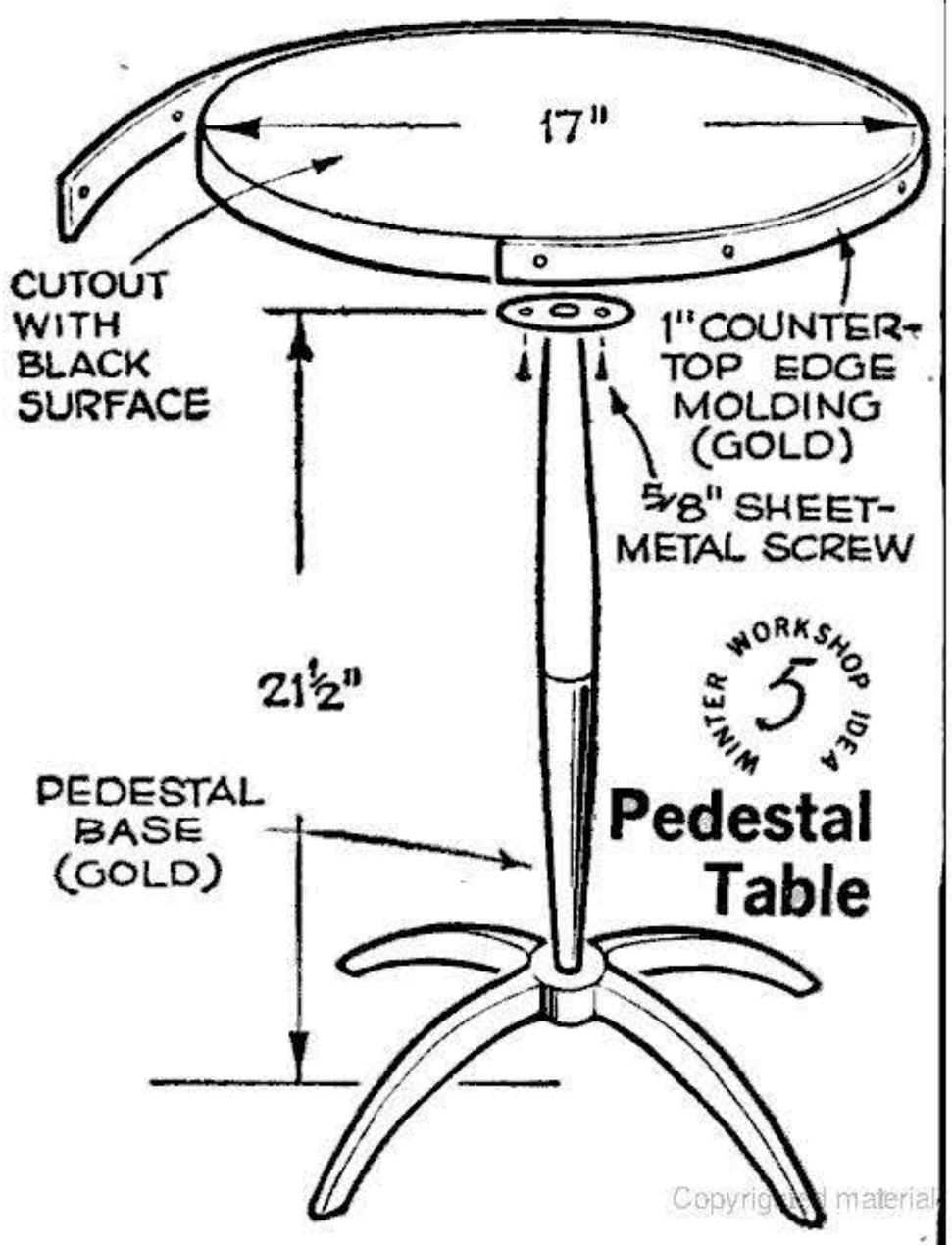
There is also molded wood trim, an

Top for coffee table was cut to size with saw blade set at 30 degrees. Edges were finished with flexible wood tape. A wood molding or plastic laminate could be substituted, if desired. Factory-made legs are available in several styles. They screw into hardware installed under the top.



Coffee Table

Handsome, yet simple, this table began wi attractive black circular cutout and was pleted with legs and metal edge molding colored) from Sears. To attach molding, end in place and bring the strip around you're back at start. Cut molding with hac



Pedestal Table

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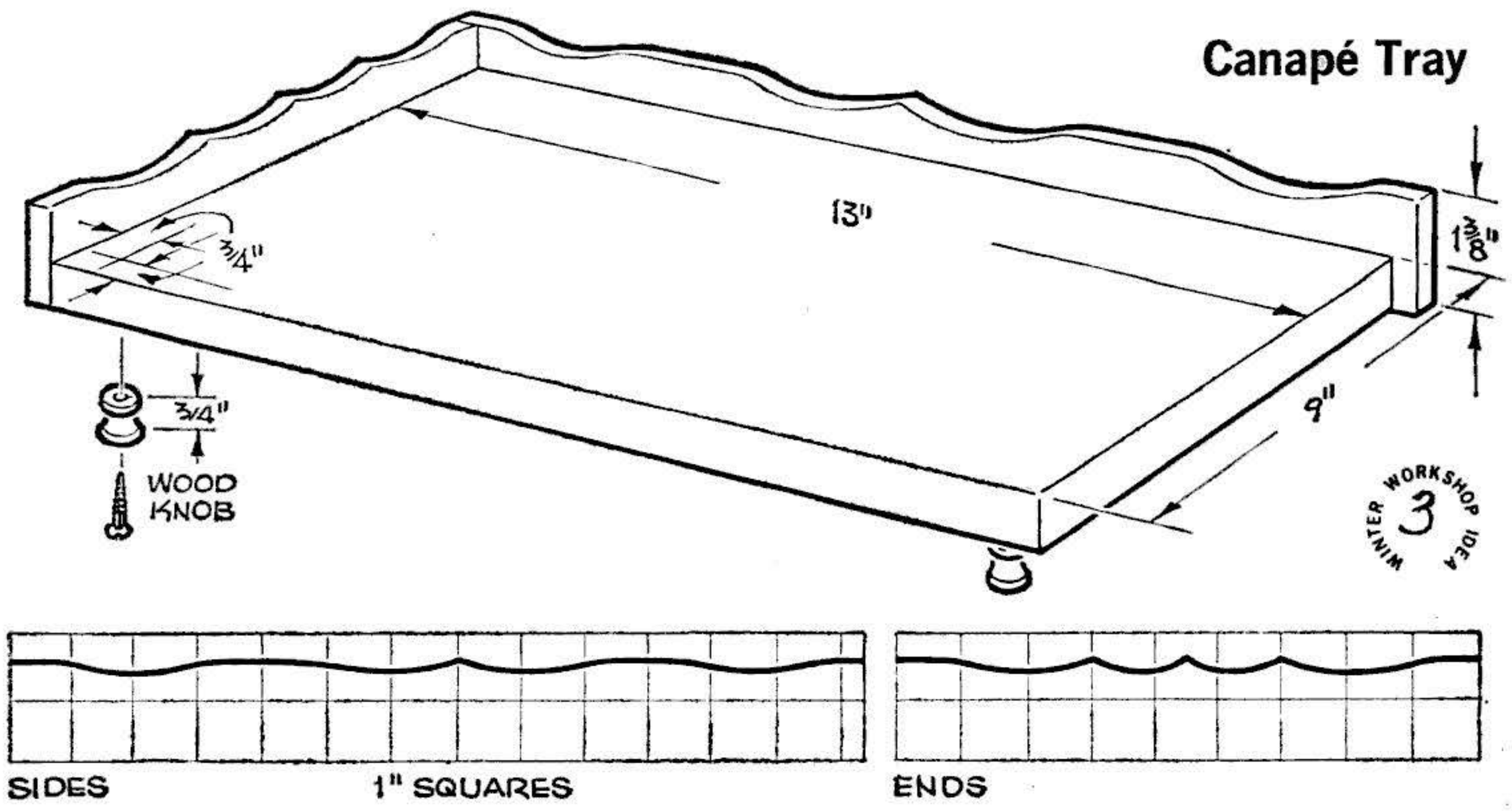
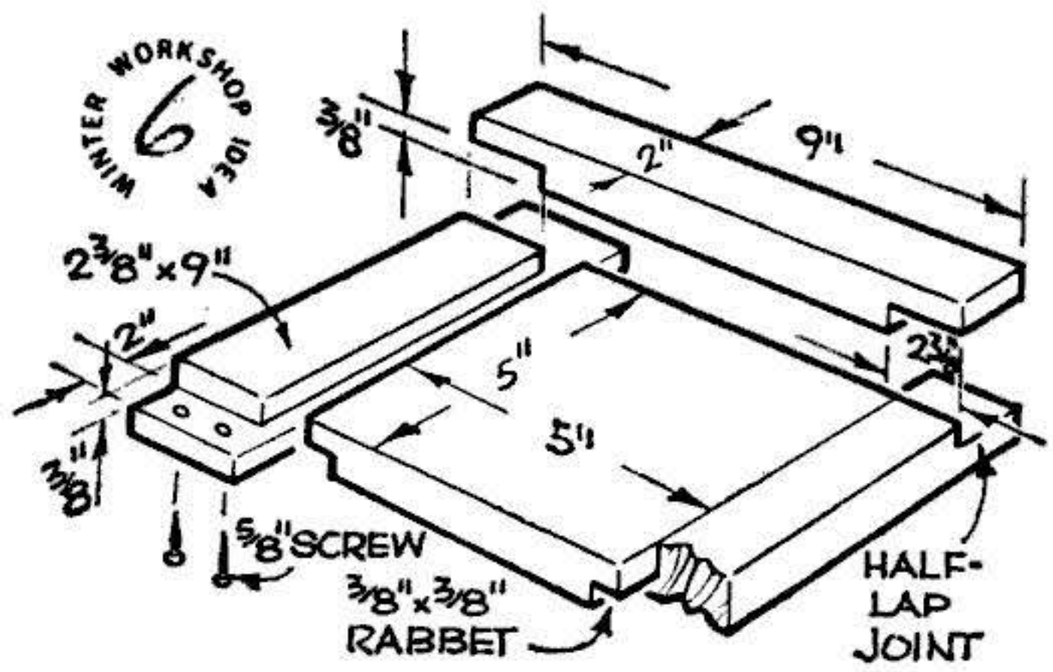


To keep weight of tray as low as possible use a cutout made of plywood rather than particle board. Sides are ½" pine attached with glue and well-set four-penny finishing nails. To prevent wood-knob legs from scratching table tops, glue felt under each one. The tray shown was finished with oil stain. Corners and nail holes were antiqued with burnt umber. Two coats of lacquer finished the job.

shelf edge (plain or striated). Both are attached with brads and glue. Veneer can always be used and, if you have some decent plywood scrap kicking around the shop, you can make your own.

Nonwood edges. Snap-on molding is the most commonly used, but for rounded shapes (like the pedestal table), the type you screw on is best. Plastic-laminate self-edge makes a good-looking finish but is limited to straight edges and large-radius bends. And finally, if you plan to paint the edges, they must be filled, sanded, and sealed first.

You can use your favorite finishing method on any of the projects shown except the cheese server and the cutting board. Because they contact food, rub the wood surfaces with salad oil. PS



Cheese Tray

A walnut surround (or walnut plywood with the edges taped) cradles the cheese-holding cutout. The four walnut pieces are glued and screwed together. Rabbet the cutout on two sides and hold it in place with screws only. Then the insert can be changed, if desired. To finish, rub the wood with salad oil.

What would you make with a cutout? It might be worth money

Turn your imagination loose. What project would *you* dream up to put a counter top to work for you? The items we've shown here are just a beginning.

The editors of POPULAR SCIENCE would like to publish other original ideas. But to be acceptable, projects *must* be original—and different. If you think yours is, describe it briefly and send a photo and a sketch giving dimensions and other data.

Payment will be made for those projects the editors find acceptable for publication. Send along postage if you want your contribution returned. Address:

Shop Editor, Popular Science
355 Lexington Ave., New York, N. Y. 10017.

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Two Unusual Gifts:

Carving Board

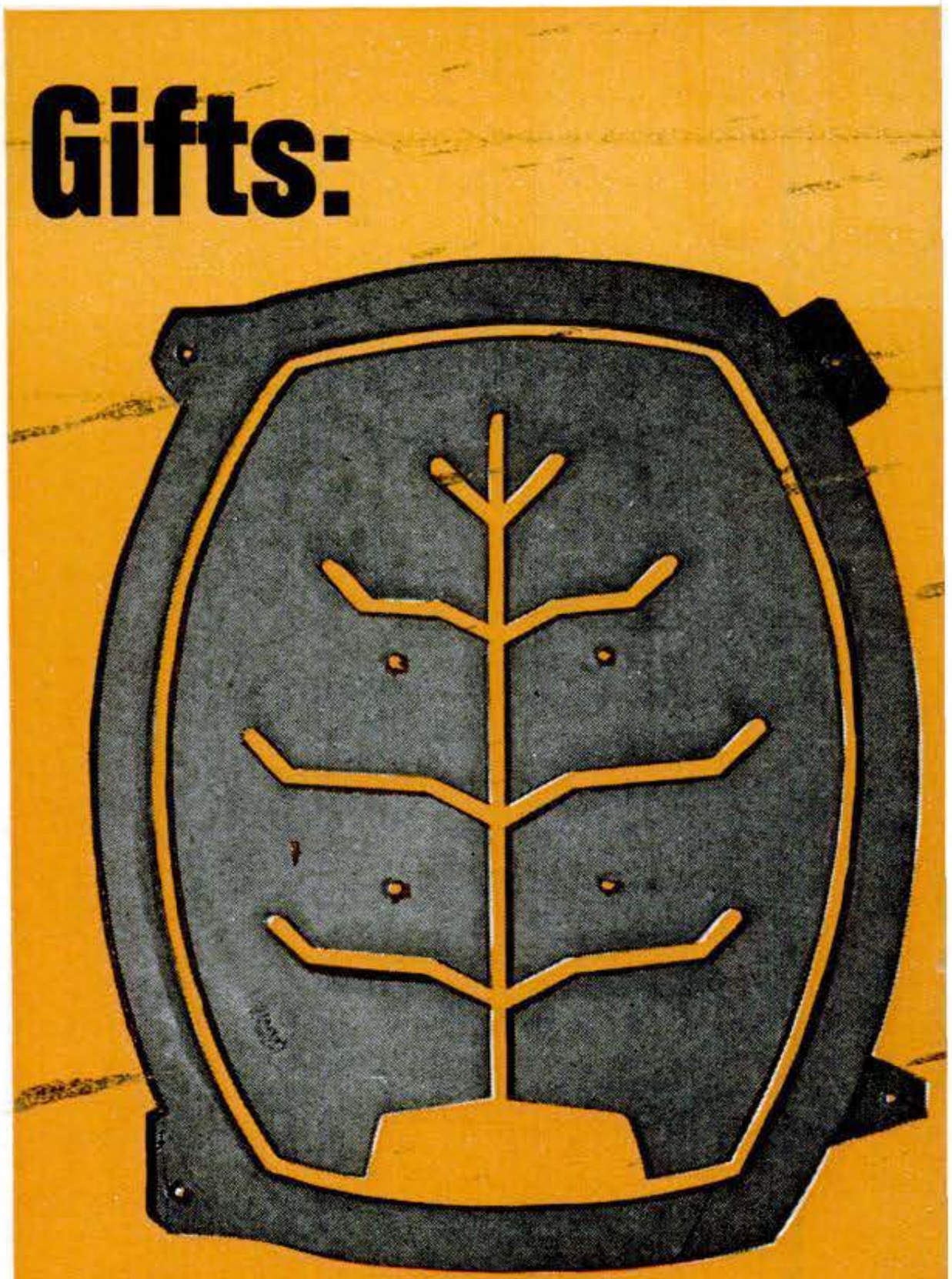
WINTER WORKSHOP IDEA 7

This well-and-tree carving board adds to the pleasure of carving by letting you bring the roast to the table in appropriately elegant style. You'll need a router to make it (if you don't have one, try a tool-rental outfit). Once you've constructed the template, you'll be able to turn out enough boards in a weekend to fill a big part of your Christmas gift list.

Jigsaw the router template from 1/4" hardboard. Cut around the contour of the center section first, and save the trimmed-off piece for the template's outer section. Saw the guide slots slightly undersize and file to the exact size of the 1/4" router-bit shank.

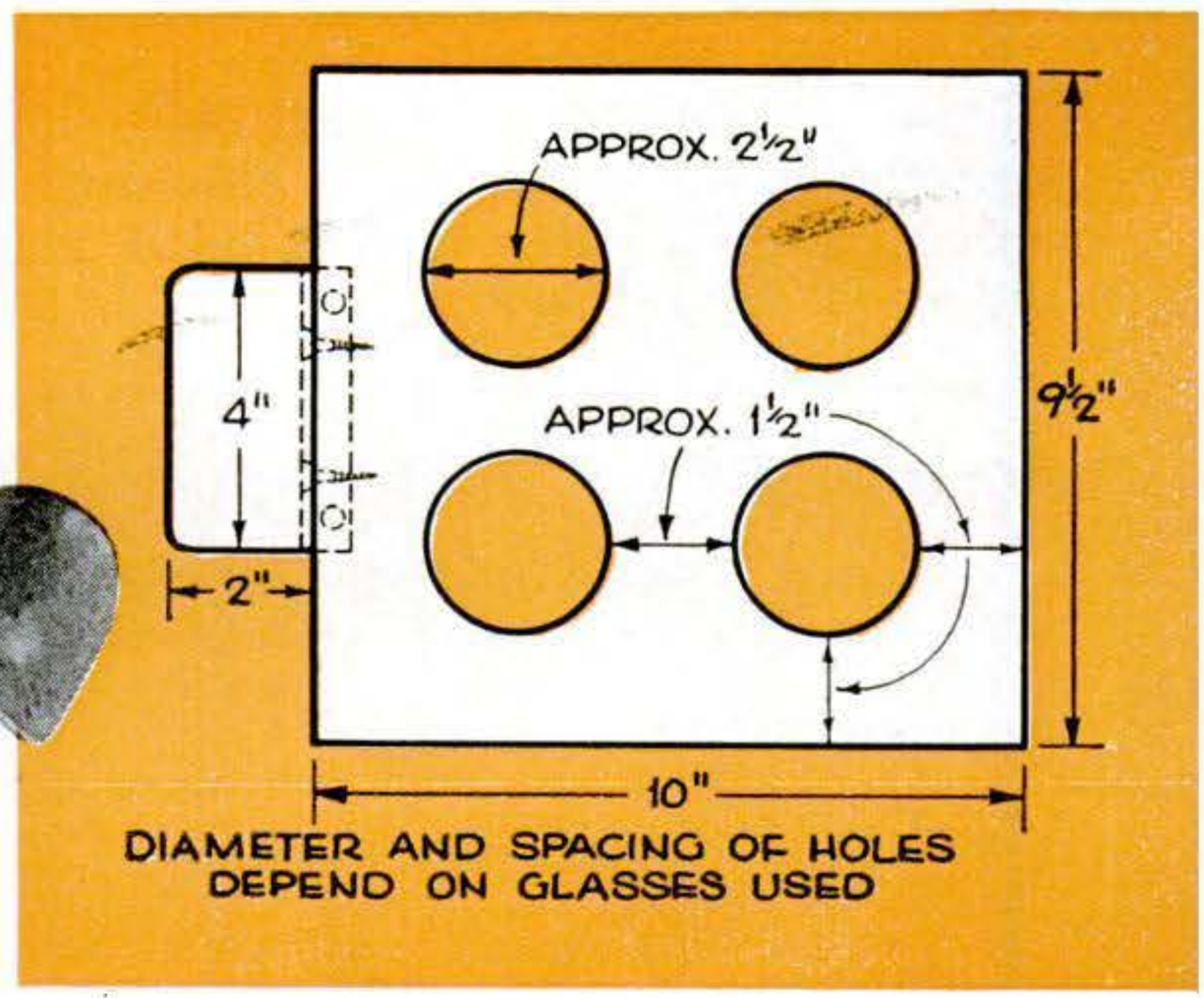
Cut the hold-down lugs and stand-offs from scrap hardboard and glue them in place. Be sure stand-offs are under each of the four screws in the center section, and that there is clearance around the slots for the 5/8" half-round router bit used to make the grooves.

Make the carving board from a 14"-by-17" piece of 3/4" hardwood. Walnut was used here. If you use a glued-up board, keep the joint off center, and see that dowels are not in a spot where they'll be exposed by the board's routed design.



The board in use at far right was made with a router and the template shown above. Using the template, any number of carving boards can be made quickly.

Make trial cuts on scrap pine or plywood. Screw the center section of the template to the stock with four #7 flathead screws. Carefully locate the outer template, using the router-bit shank as



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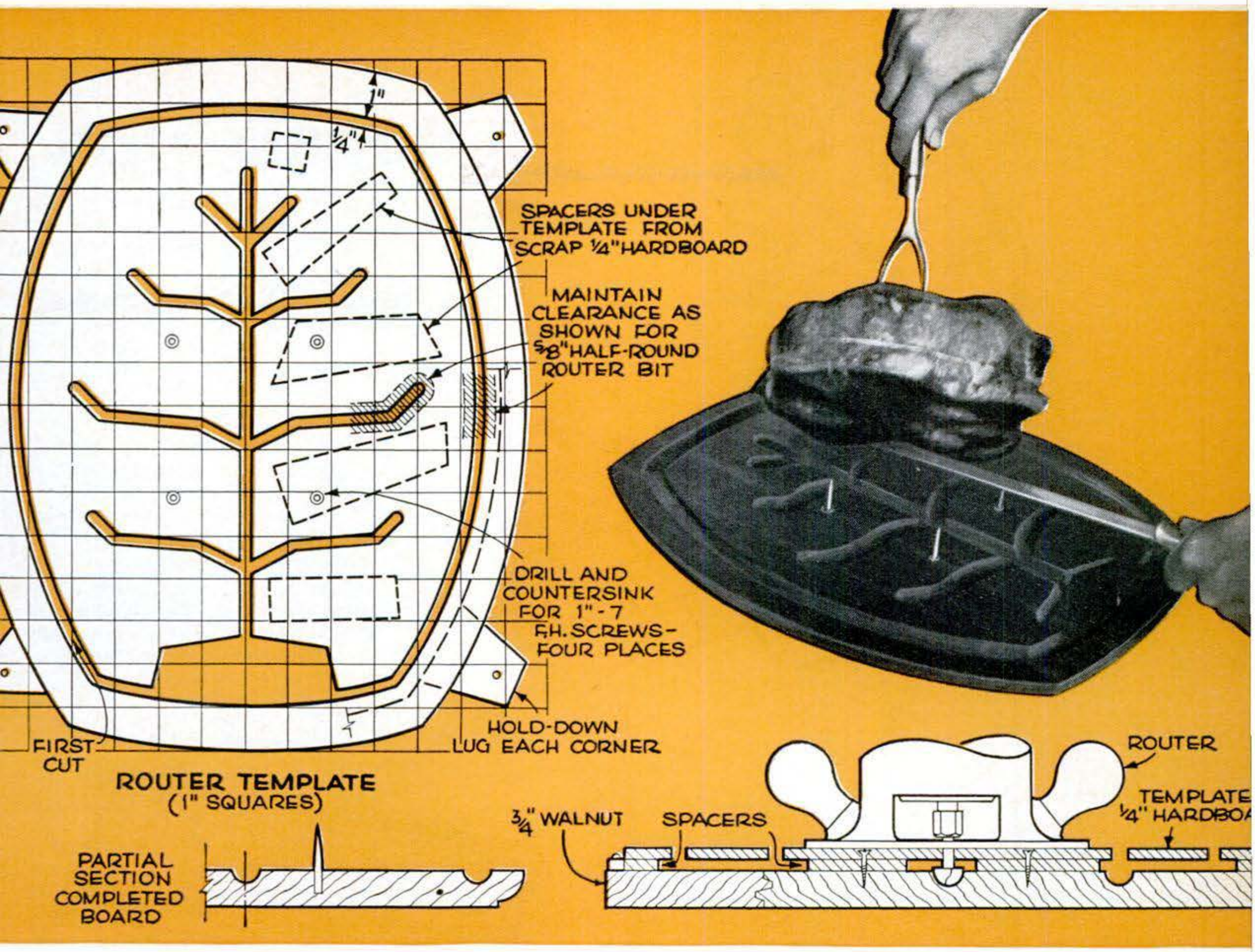
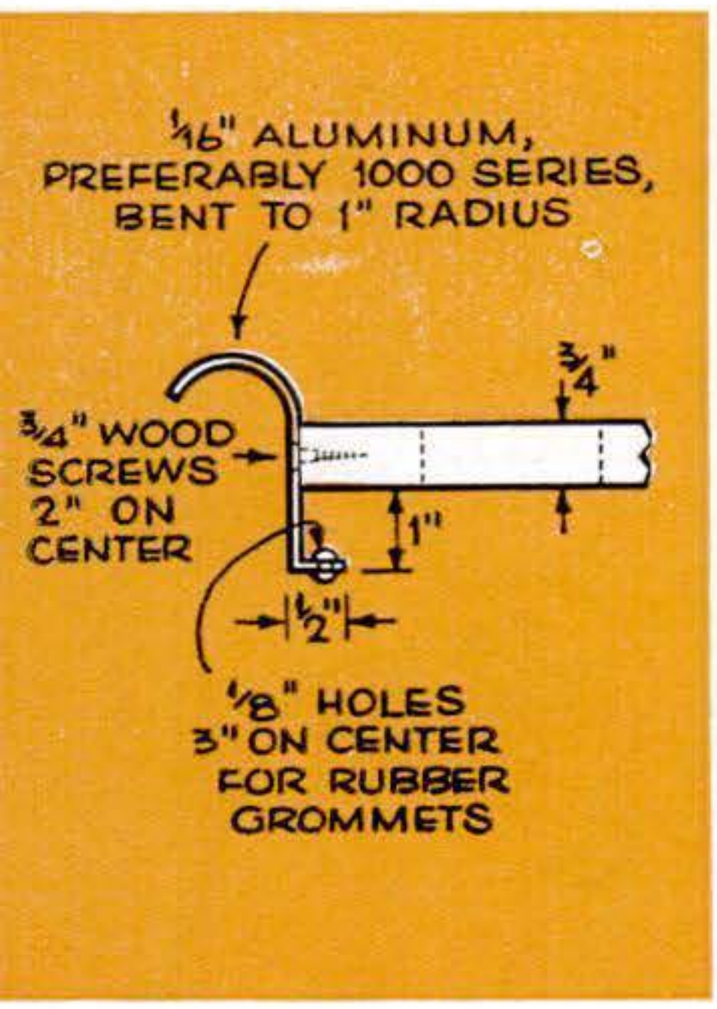


a guide. After routing, mark the outside edges and remove the template. Saw the outside edges, sand, and finish with a molding router bit around the edge. Finish-sand the entire board.

Use 3/16" stainless-steel rod for the meat-holding spikes. Point them with a file while they're chucked in a lathe or drill press. Bore out the four screw holes and glue the spikes in place.

Wipe the wood with hot salad oil for a finish that can be readily restored.



Beverage Server

WINTER WORKSHOP IDEA

Here's an attractive server that is spillproof. This one holds four glasses, but size can be varied. Tapered glasses wedge into holes cut in a hardwood board. The holes should be sized so that the glasses extend down about an inch below the base. The holes can be made with a fly cutter in a drill press, or jigsawed after first drilling a small hole for the blade.

Curve the aluminum handles by bending them around a piece of pipe. The handles should extend 1½" below the bottom of the tray so glasses are held above the resting surface. Rubber grommets prevent marring furniture.

For a handcrafted look, peen the handles; and for a tough, alcohol-resistant finish, coat the wood with a tough penetrating resin varnish.

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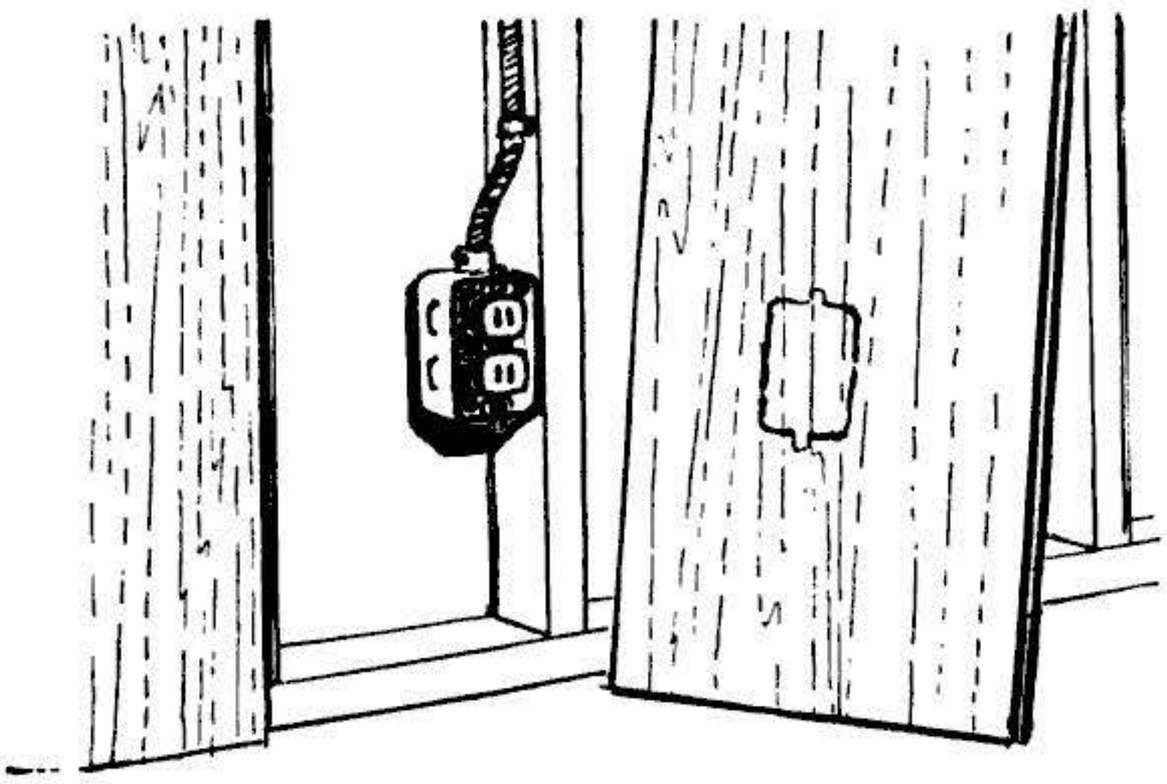
5 Repair Tips for Home Owners

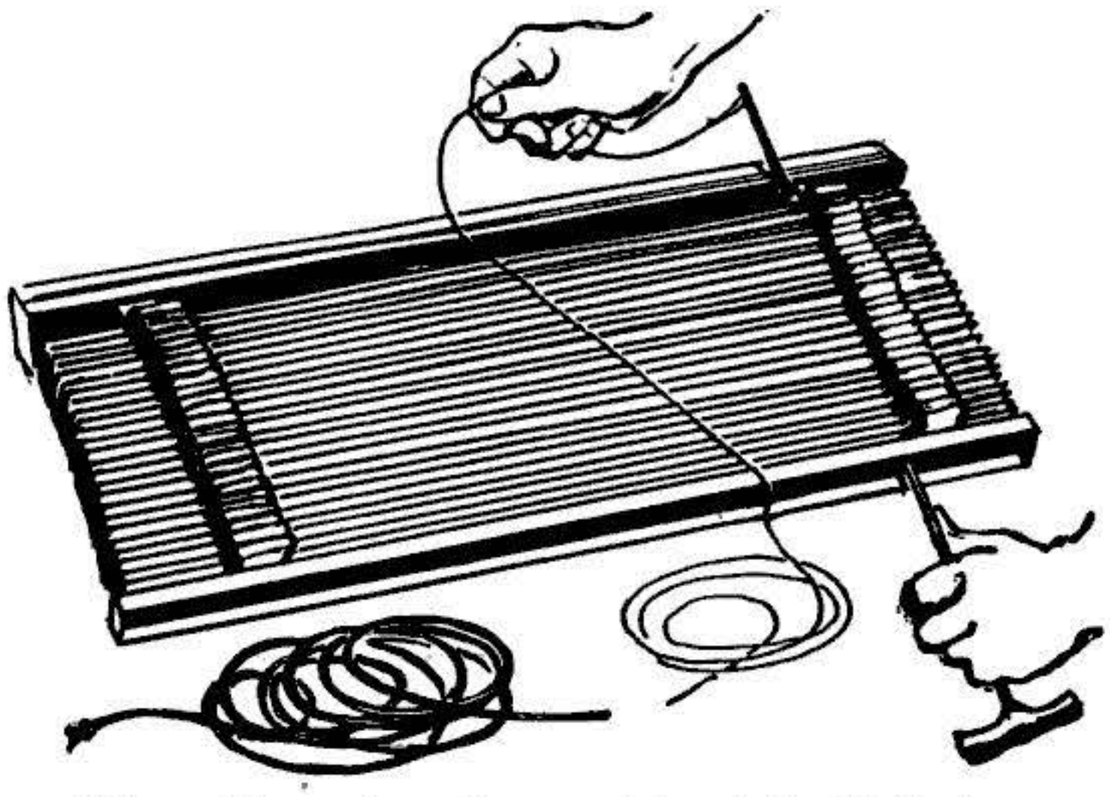
WINTER WORKSHOP IDEA 9

Next time you need to repair damage on your roof, spread roof cement on the damaged area. Sprinkle shingle granules of the same color on the cement and tamp them in place. The patch saves replacing the shingle and isn't noticeable. There are usually loose granules in the gutter.



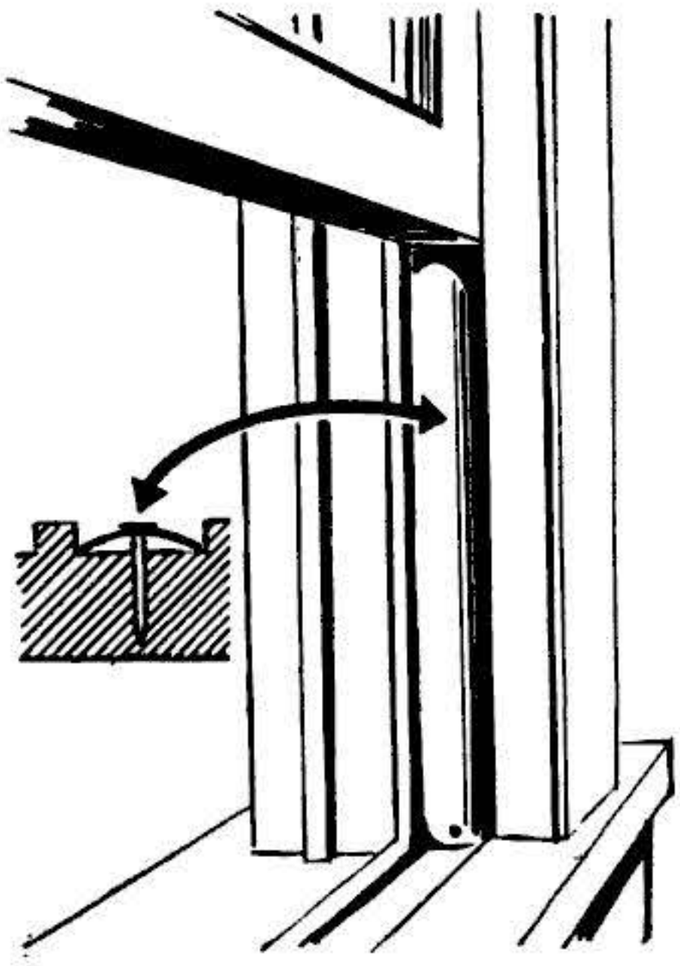
WINTER WORKSHOP IDEA 10

When you're installing wall paneling and you come to an outlet box, smear the box edges with red wax crayon. Hold the panel in position and strike the face with the palm of your hand. Crayon marks are transferred. Using a saber saw, cut from the back.



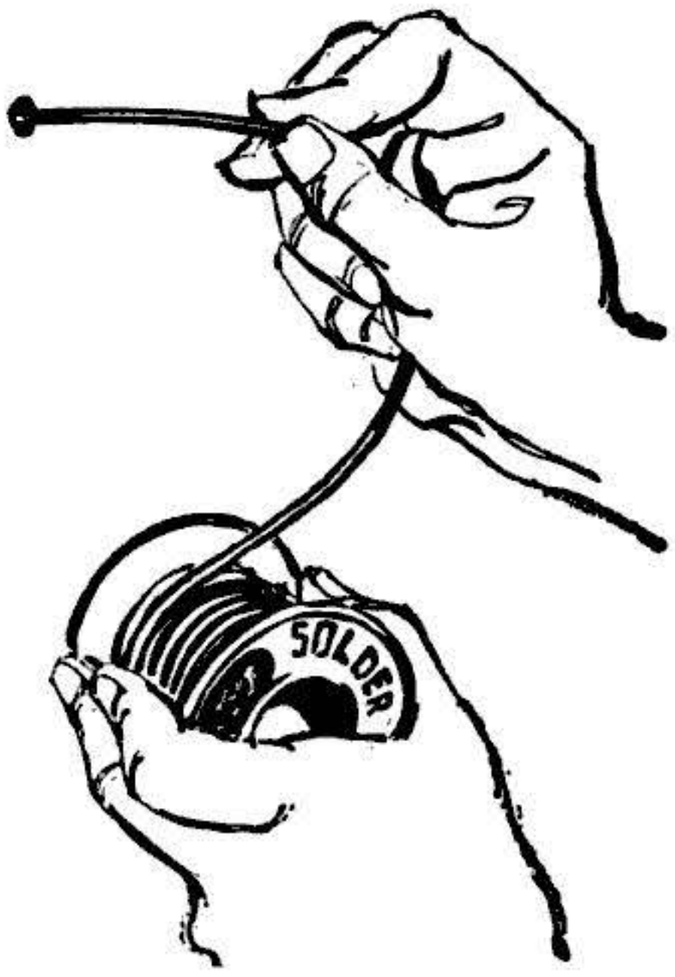
WINTER WORKSHOP IDEA 11

To replace the cord in slatted blinds, run a .22-rifle cleaning rod up through the slats from the bottom. Tie a fishing line to the slot in the end of the rod, and withdraw the rod and line. Fasten new Venetian-blind cord to the line and pull it into place.



WINTER WORKSHOP IDEA 12

Tighten loose windows by nailing a section of Venetian-blind slat in the sash track. Nailed only at the top and bottom, the convex side stays out, providing spring tension so the window won't slide. Very loose windows may need slats on both sides.



WINTER WORKSHOP IDEA 13

To hold screws in concrete, masonry, or plaster try this: Drill a hole, insert wire solder to the depth of the hole, and snip it off flush with the surface. As the screw is driven, the soft wire packs around it, holding it securely. In large holes, use two strands.

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Make Toy Building Logs

stock of any length handy. Part H is made by halving an A piece.

The gable-roof section (part E) and the chimney (part F) are simply cut according to the drawing, and the roof planks (part I) are ¾″ pine ripped to ½″ widths.

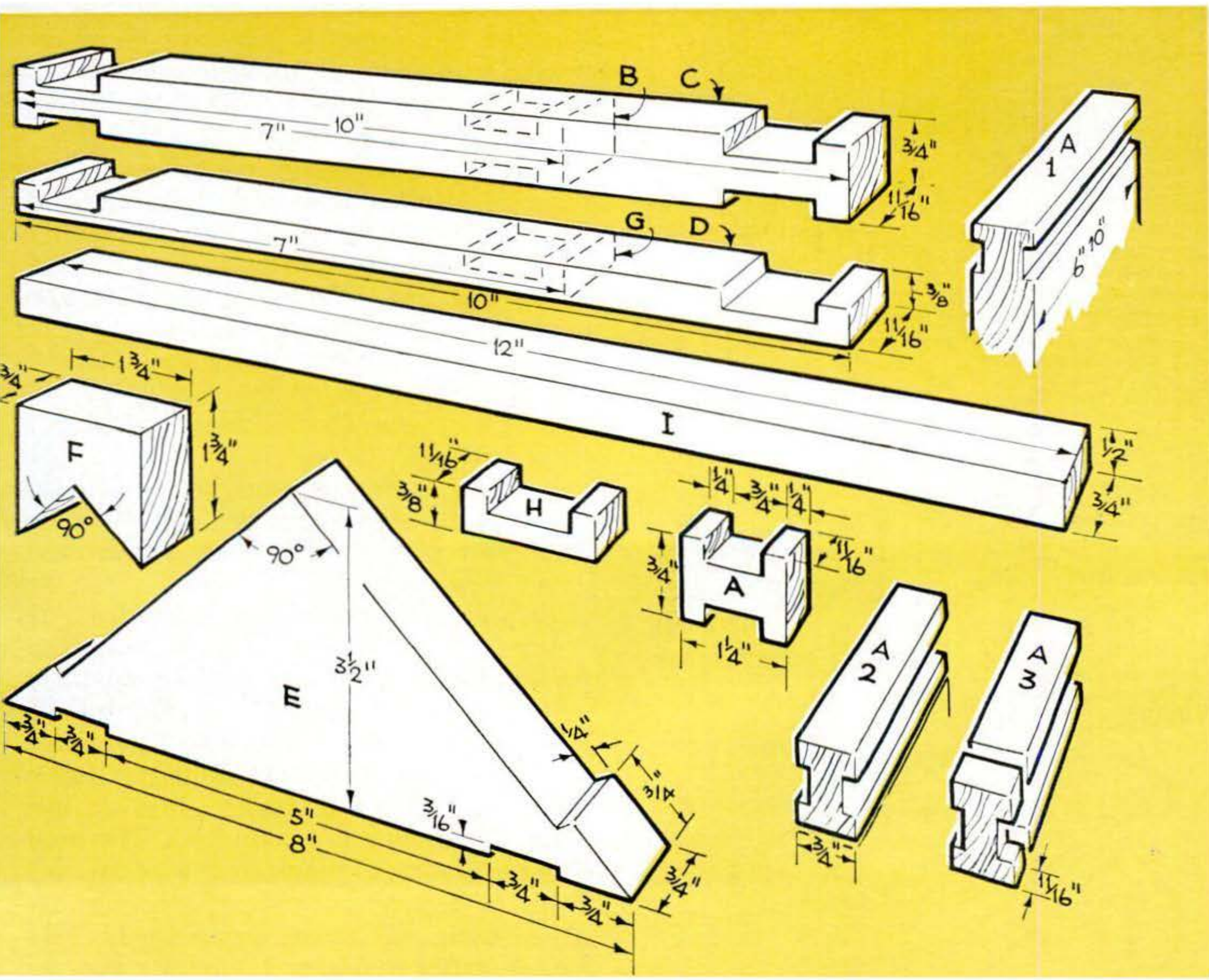
Interlocking the logs. The slots for the logs are cut with a router (the inexpensive Stanley Rout-About was used here), using a guide fence and a ¾″ two-flute bit. Set the cutter to rout a slot 3/16″ deep; set the guide to let the bit cut the groove ¼″ in from the end of the board. Make practice cuts on scrap until you get the proper setting. Once the router is set, don't change it until all of your cuts have been completed.

Clamp the stock securely to the bench or in a vise when you cut the slots. On parts B, C, D, G, rout notches on each side of each end of the board, then rip the board into 11/16″-wide strips.

To make the A parts, rout a notch on each side of one end of the board, then cut off the notched end ¼″ past the edge of the notch. The cutoff piece is then ripped into 11/16″-wide blocks.

Just keep in mind that the 11/16″-wide logs are to fit into ¾″-wide slots. This gives enough clearance for an easy fit. If you rip the logs a bit too wide, you can sand them to fit.

You make the same basic parts for other buildings; you can even vary the log lengths to suit your individual projects. There's just one basic rule: Always make at least as many A parts as all the other logs combined, since these will be used for corners, spacers, and supports for building all structures.



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Toy Steam Engine Has a Secret

It looks like a chuffer—it's really run by a hidden turbine

By ROY L. CLOUGH JR.

WINTER WORKSHOP IDEA 16

When grandpa was a boy, he went to bed on Christmas Eve dreaming of toy steam engines that ran like the big ones. A boy *you* know can awake Christmas morning to his own replica of a live steam toy if you're handy with a soldering iron.

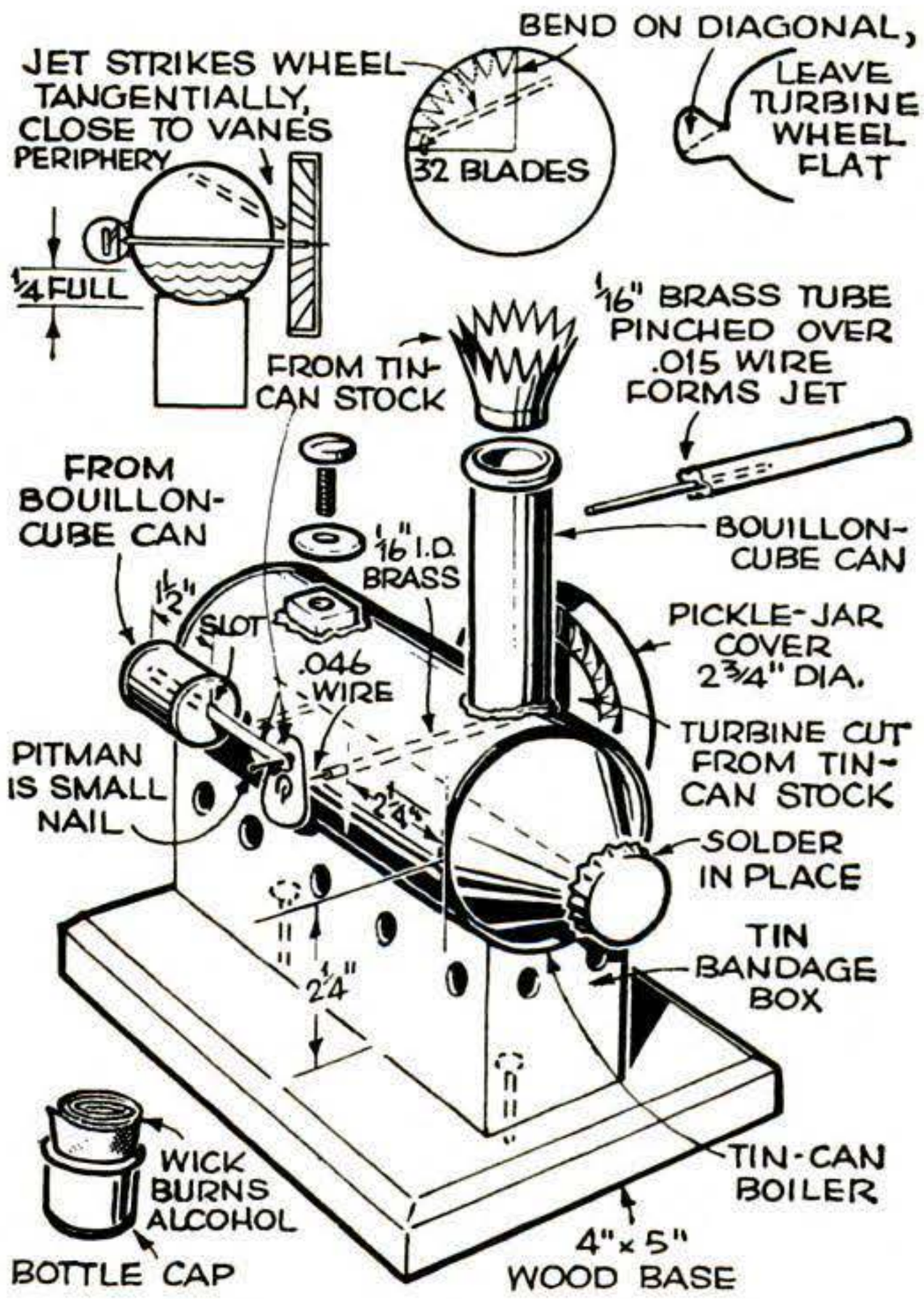
The engine only *looks* complicated. You have no tricky piston and cylinder fit to fuss with—a turbine hidden in the flywheel is what really runs it.

It's safe, too. The steam nozzle is large enough to keep the pressure down. You can't get enough fire under the boiler to blow it up and the burner—a simple wick-type affair—won't spill blazing alcohol if tipped over.

For the boiler, use any slant-top can with a bottle-type pressure cap (like the ones that oil additives and windshield-wiper fluid come in). Wash the can out well—and adapt it as shown in the drawing.

It's important that the wheel and dummy engine operate freely. The steam jet must strike tangentially on the turbine and be as close as possible to the blades.

The boiler is run about a quarter full of water and checked every three or four runs. Alcohol makes good fuel. The model is painted with black stovepipe enamel. Trim is bronze on engine cylinder, flywheel rim, and stack coronet. The flywheel center and crank lobe are painted red. Mount the engine on a wooden base.



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How to Create a High-Rise Bike

WINTER WORKSHOP IDEA 17

Know a youngster who'd like one of the popular high-rise bicycles? Do you already own an old bike, preferably a 20-incher? It's a simple matter to convert the last into the first. You can order parts from one of the big mail-order houses or pick them up at a local bike store.

To make the conversion in full style you need:

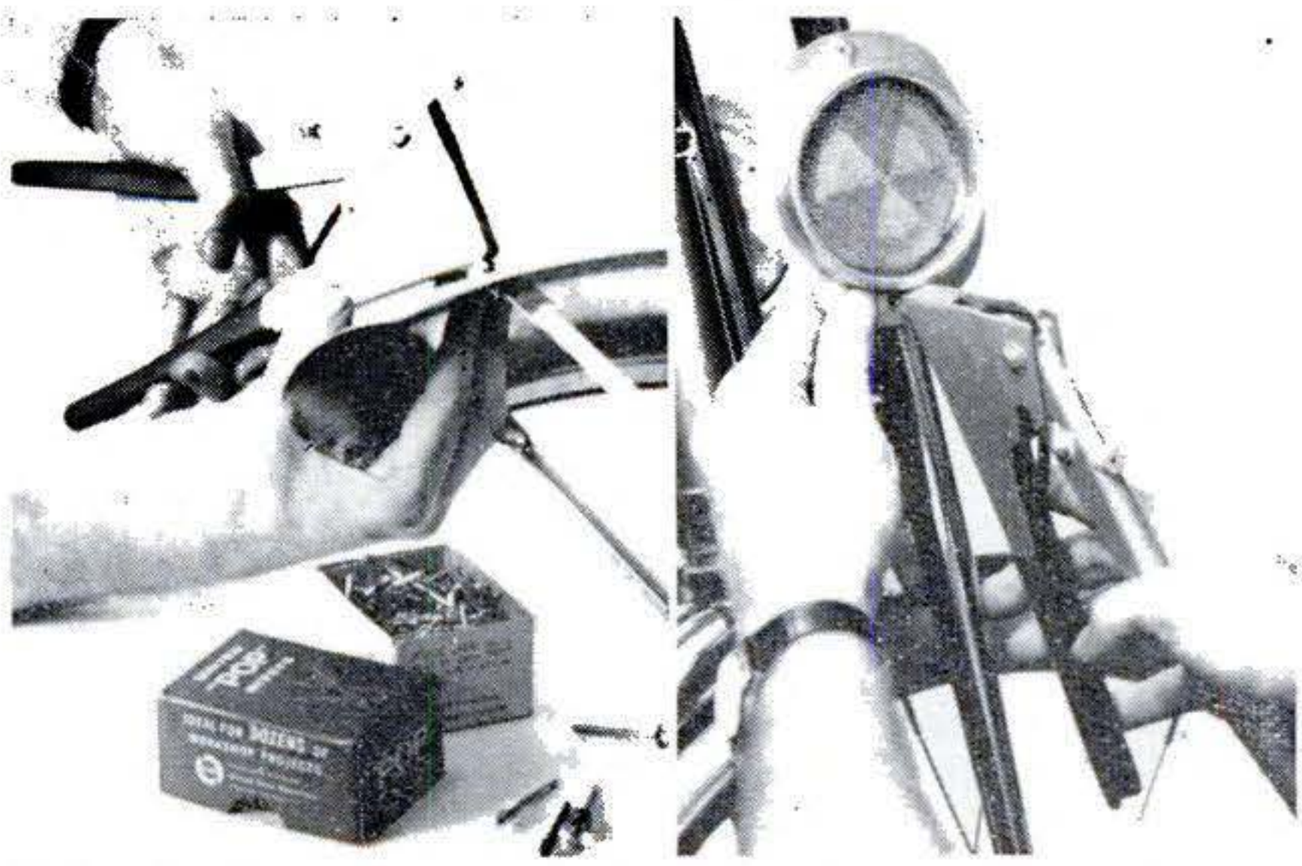
- High-rise handlebars
- A polo (or banana) seat, with or without backrest
- A knobby whitewall tire for the rear, a plain whitewall for the front
- Two chrome fenders, with brackets
- Assorted reflectors

The handlebars and seat are actually what it takes, minimally, to get the authentic look, but the rest are worth adding while you're at it.

Make the conversion by first removing the wheels and fenders. Now is the time to paint, if you're going to. A can of aerosol spray paint makes a quick job of it. If you want the bike to make a whopping hit, "tigerize" it by spraying stripes over the basic color.

Riveting on the fenders is a good idea. Eventually you wind up with fewer rattles and less need for tightening. The riveting job is easy if you get one of the new types of riveting tools now available at your hardware store.

Old 20-incher above was converted into the jazzy version at top by painting and adding new parts—high-rise seat and handlebars, a rear tire with knobby tread and slim front tire, chrome fenders, big red reflectors on both sides.



Riveting tool shown at left is ideal for fastening the new accessories to the bike. No back-up anvil is needed and the attachment is firm and secure. Big red reflectors like the one at right promote safety for a rider at night.

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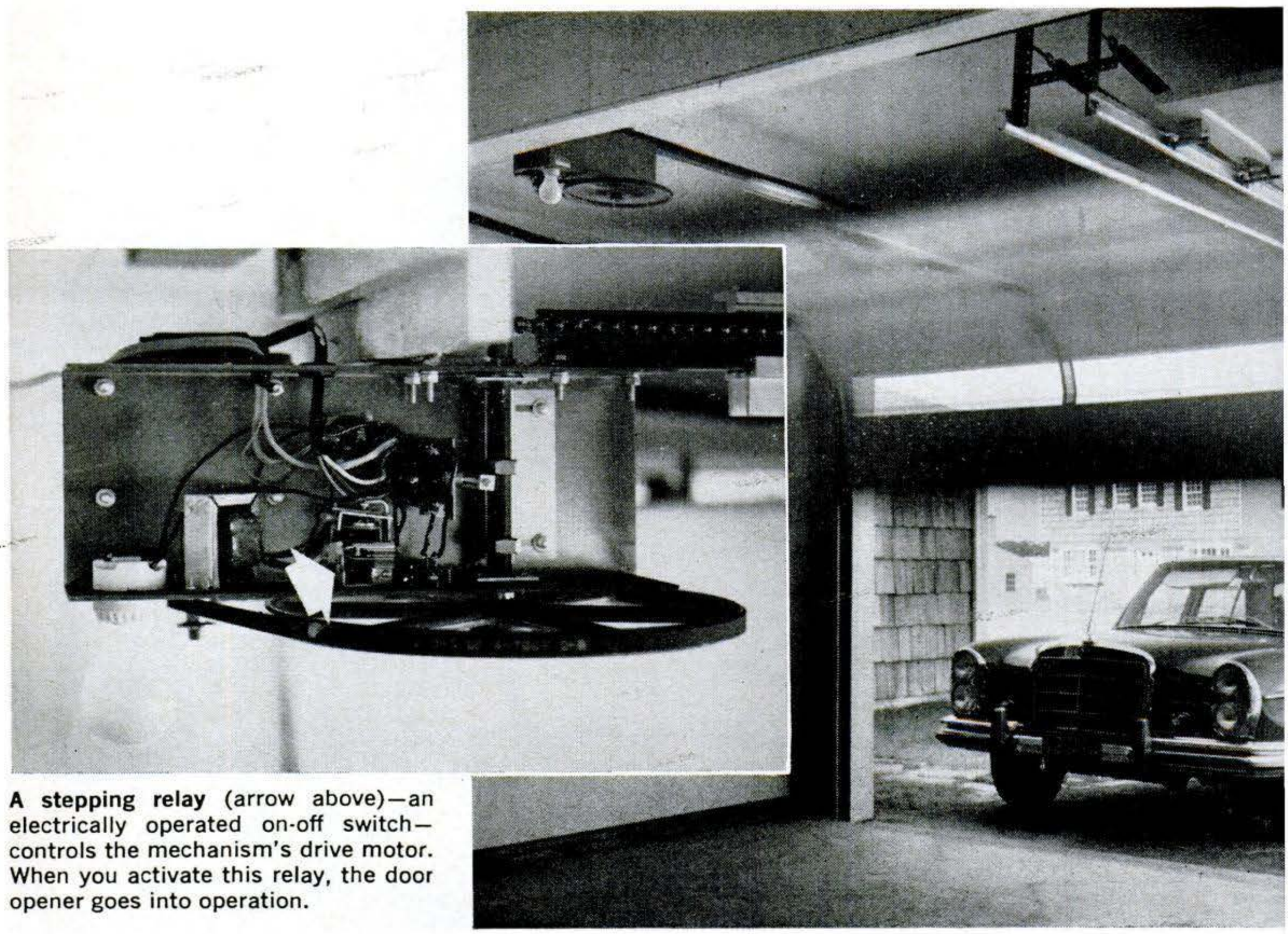
4 Tamperproof Ways to



A stepping relay (arrow above)—an electrically operated on-off switch—controls the mechanism's drive motor. When you activate this relay, the door opener goes into operation.

By RONALD M. BENREY / *Electronics Editor*
PHOTOS BY ORLANDO GUERRA

Unless you like hard work, an electrically operated garage door is a very pleasant addition to your home. But one problem is: How do you trigger the mechanism—to open or close the door—from outside your garage when you are in your car?

Here are four possible solutions. All are tamper-resistant—they require a special "key" device be used to set the door in motion.

The opener mechanism shown above is the Heathkit GDA-20-3. The ready-to-assemble kit costs $70, and is available from the Heath Co., Benton Harbor, Mich. 49022. Other available mechanisms are triggered in much the same way.

RADIO CONTROL

WINTER WORKSHOP IDEA 18

Radio control to open garage doors isn't new [see PS, Aug '59], but many early RC systems had the disagreeable characteristic of going into action each time the receiver picked up a bit of electrical static. These units operated at a frequency of 27.255 mHz, making them prone to stray interference from nearby electrical equipment, the CB'er down the block, and even overflying airplanes.

Fortunately, a recent Federal Communications Commission frequency allotment changed all that: Garage-door-opener RC systems can now operate in several different frequency bands above 200 mHz. At these elevated frequencies, there's not enough static or interference to pose a problem.

As a bonus, the transmitter and re-

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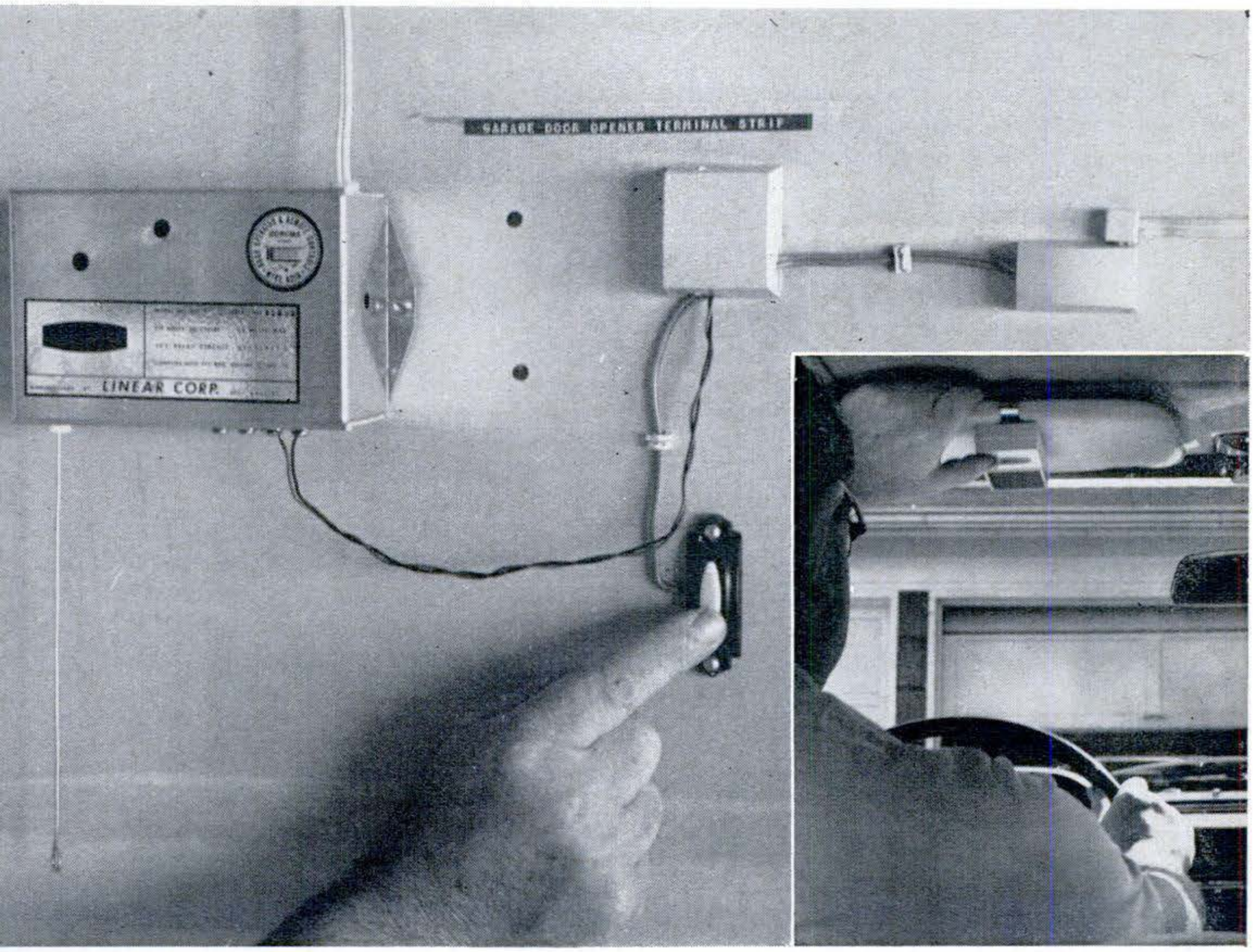
Operate Your Garage Door



ceiver can be extremely compact, since antennas, tuned circuits, and other frequency-selective components are small.

The radio-control receiver shown above is typical: Note its very short receiving antenna. The transmitter, right, is the size of a cigarette pack. The system's operating range is about 100 feet.

The receiver is connected to a terminal strip mounted on the garage wall, along with a pushbutton switch. This terminal strip is connected to the garage-door mechanism via a two-conductor cable. Thus, the garage-door mechanism can be triggered by either the driver of the car—by radio control—or by someone inside the garage pushing the button switch.

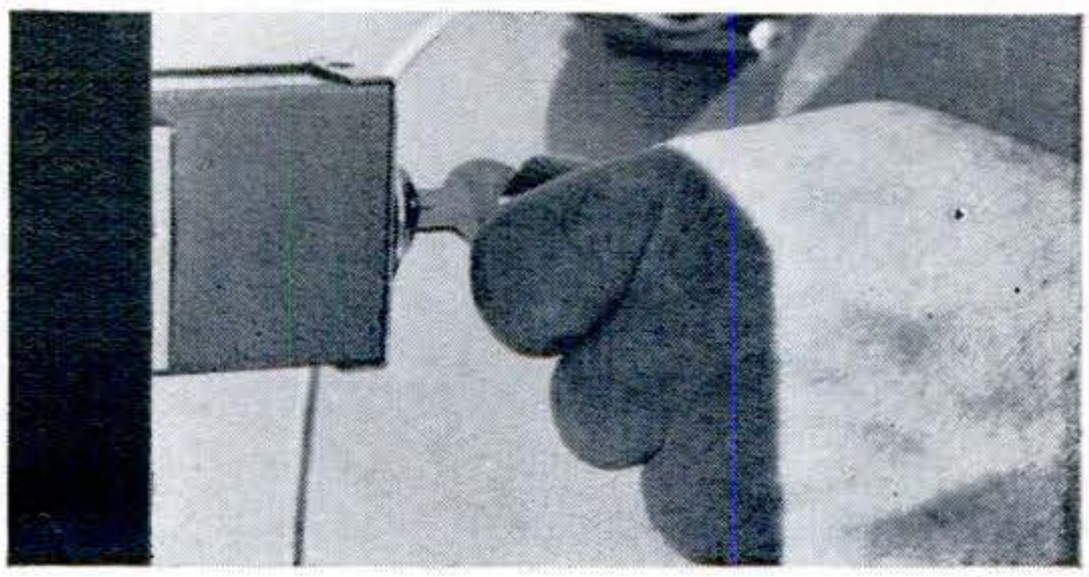
The RC system shown here is made by the Linear Corp., 347 Glasgow, Inglewood, Calif. 90301, and is sold by the Heath Co., along with their mechanism. The system costs $55.

Continued

KEY SWITCH

WINTER WORKSHOP IDEA 19

This is by far the most secure method. Use a spring-return normally open key switch, and mount it in an aluminum minibox. Place it at car-window height on a post. Use low-voltage underground cable to connect the switch to the opener's relay.



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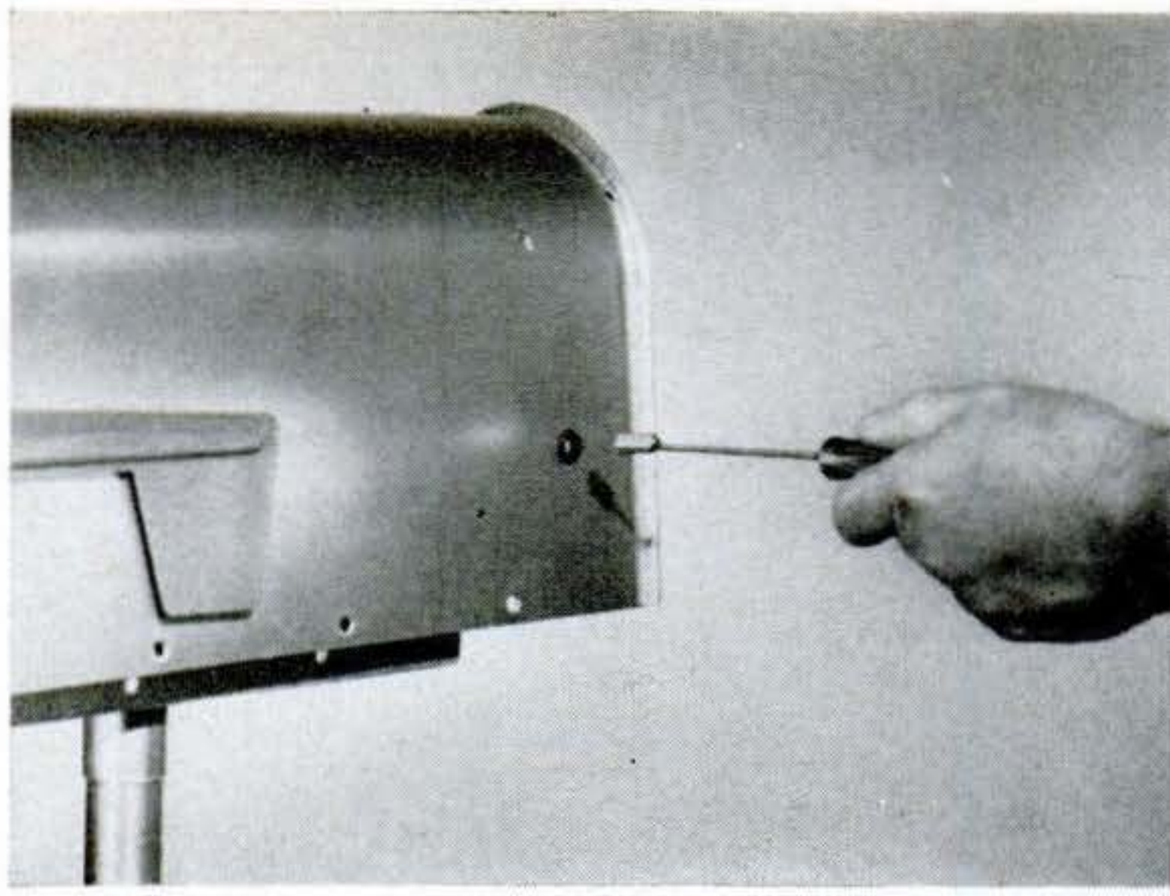
MAGIC WAND

WINTER WORKSHOP IDEA 20

We call it a magic wand, but actually it's a small screwdriver that has a small permanent magnet epoxy-cemented to its tip. You use it to activate a small glass-enclosed "reed" switch (GE type X-7, available at most electronic-supply houses). As the photo at far right shows, the two switch contacts snap closed when the magnet is brought alongside the switch.

A suburban mailbox makes a good mounting location, as the photo and sketch at right show.



INDUCTION COIL

WINTER WORKSHOP IDEA 21

This method uses a low-frequency (100 kHz) transmitter mounted in your car that broadcasts an "open-sesame" signal to a matching garage-mounted receiver.

The transmitting antenna, L1, goes in a convenient spot under the front bumper; the receiving antenna, L2, should be buried just under the surface of your driveway.

To operate the system, you momentarily stop your car so that the transmitting antenna is positioned over the receiving antenna, and you press pushbutton switch SW to activate the circuit.

Antenna coil L1 has 55 turns of

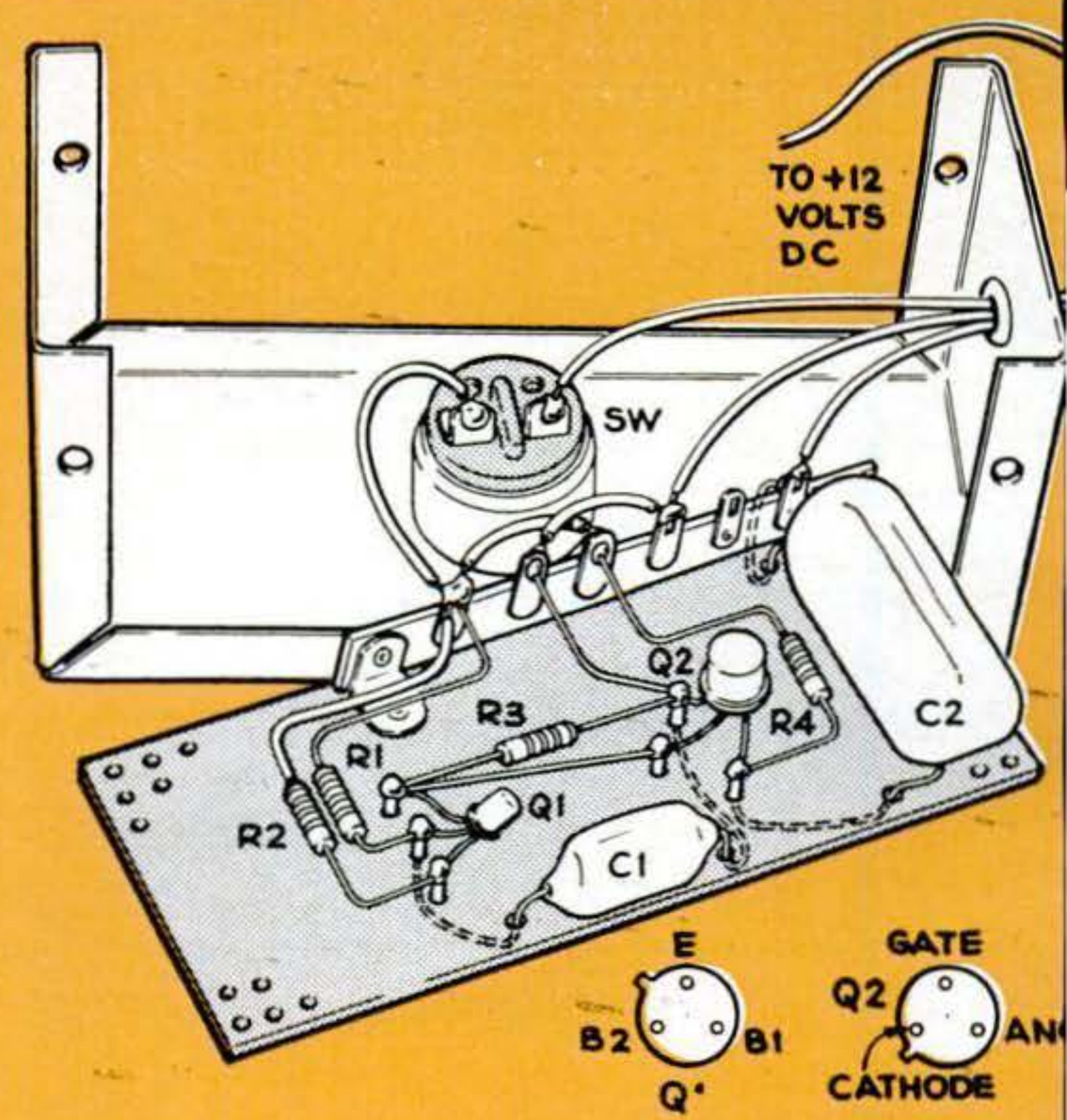
PARTS LIST

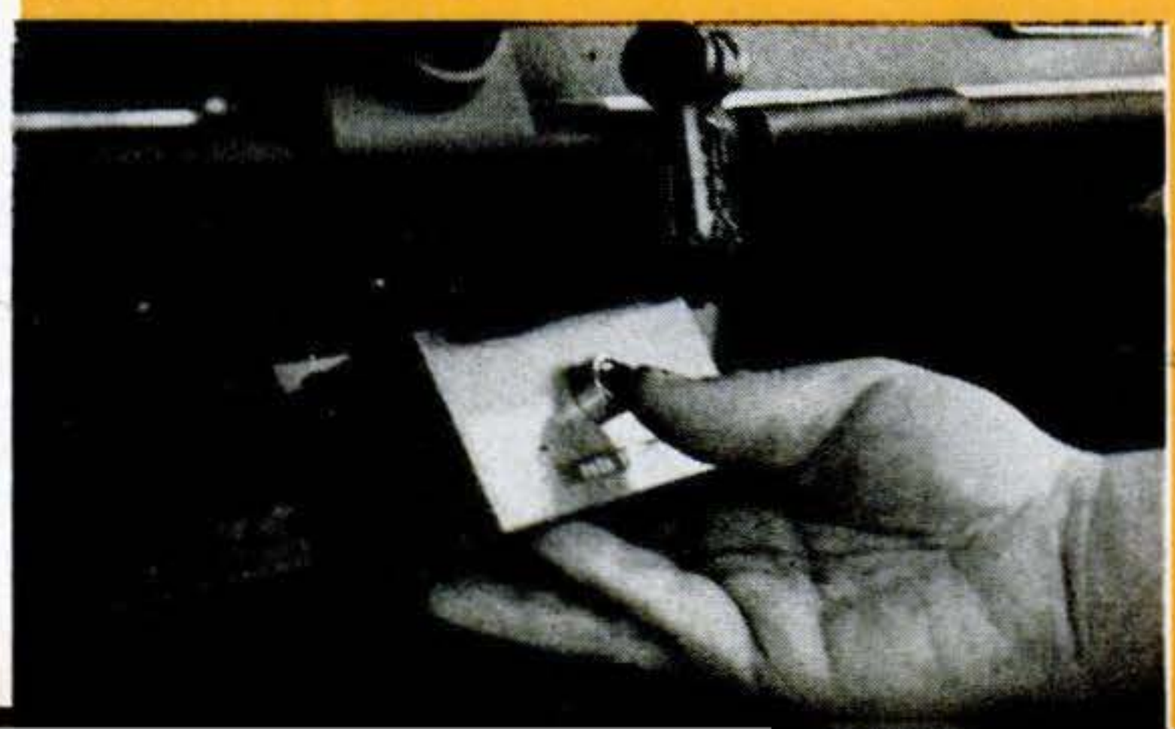
Transmitter

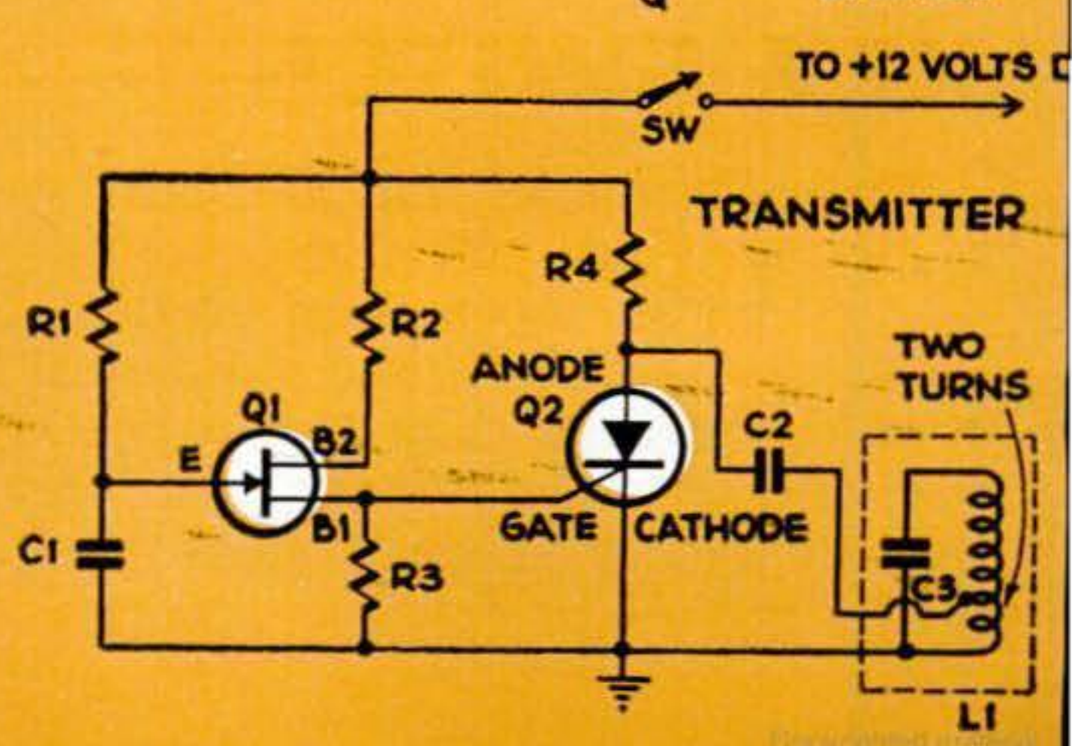
R1—15,000-ohm ½-watt carbon resistor
R2—220-ohm, ½-watt carbon resistor
R3—10-ohm, ½-watt carbon resistor
R4—470-ohm, ½-watt carbon resistor
C1—.33-mfd paper capacitor (any voltage)
C2—1.0-mfd paper capacitor (any voltage)
C3—.001-mfd paper capacitor (any voltage)
Q1—GE-type X-10 unijunction transistor
Q2—GE-type X-5 silicon-controlled rectifier
SW—SPST momentary-action pushbutton switch
L1—transmitting antenna (see text)

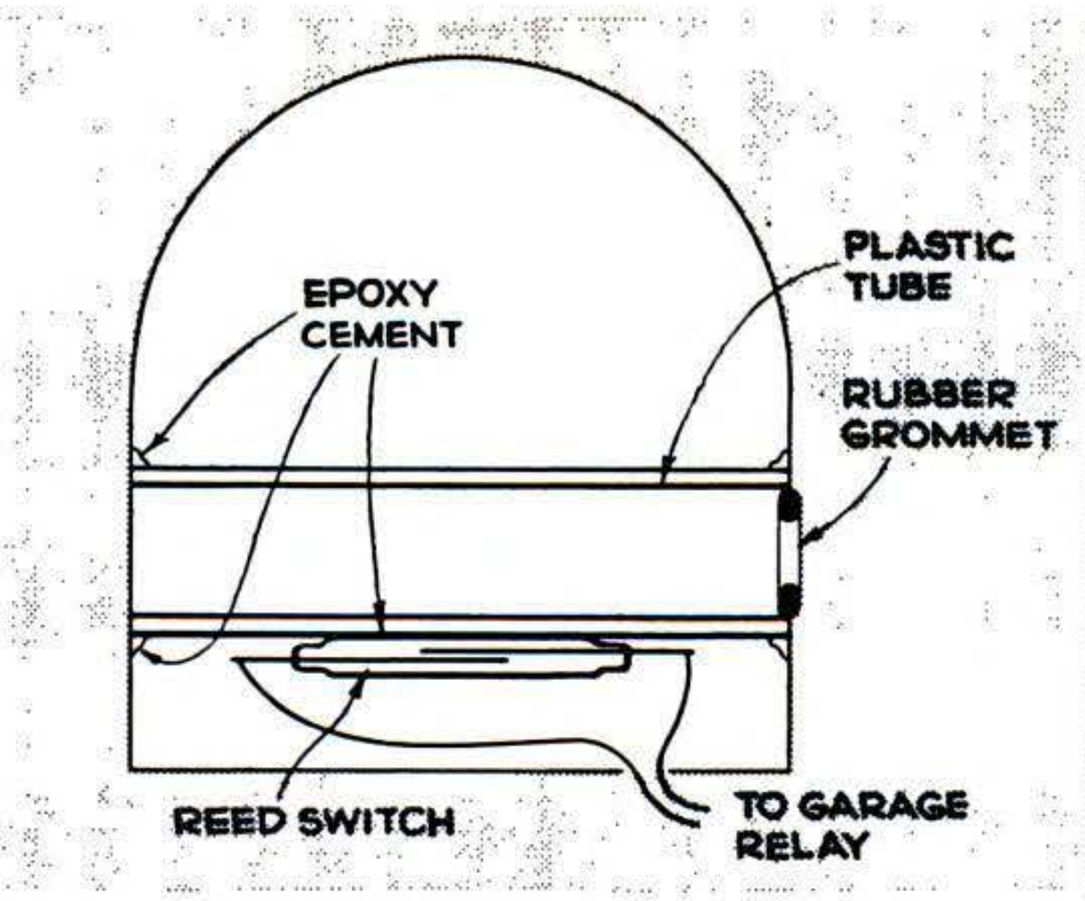
Receiver

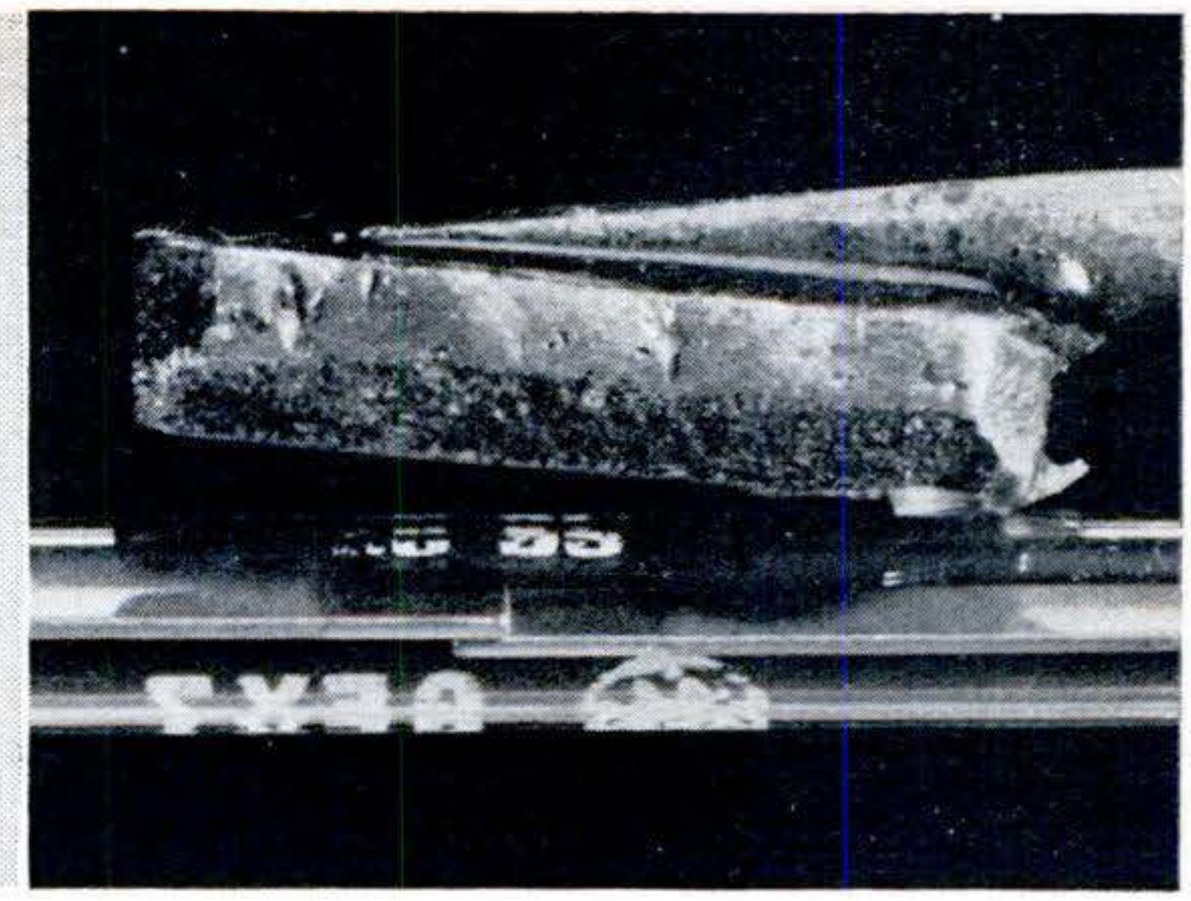
R5, R9—33,000-ohm, ½-watt carbon resistors
R6, R10—10,000-ohm, ½-watt carbon resistor
R7, R11—3,300-ohm, ½-watt carbon resistor
R8, R12, R13—330-ohm, ½-watt carbon resistor
C4—.001-mfd paper capacitor (any voltage)
C5, C6—1.0-mfd, 25-volt electrolytic capacitor
C7—10-mfd, 10-volt electrolytic capacitor
C8—500-mfd, 25-volt electrolytic capacitor
Q1, Q2, Q3—2N2925 NPN transistors
D1—1N34A germanium diode
D2—GE 504 silicon rectifier
L2—receiving antenna (see text)
RL—miniature relay, Lafayette 99H6091
Filament transformer—12.6-volts AC @ 2 amps, (see text)









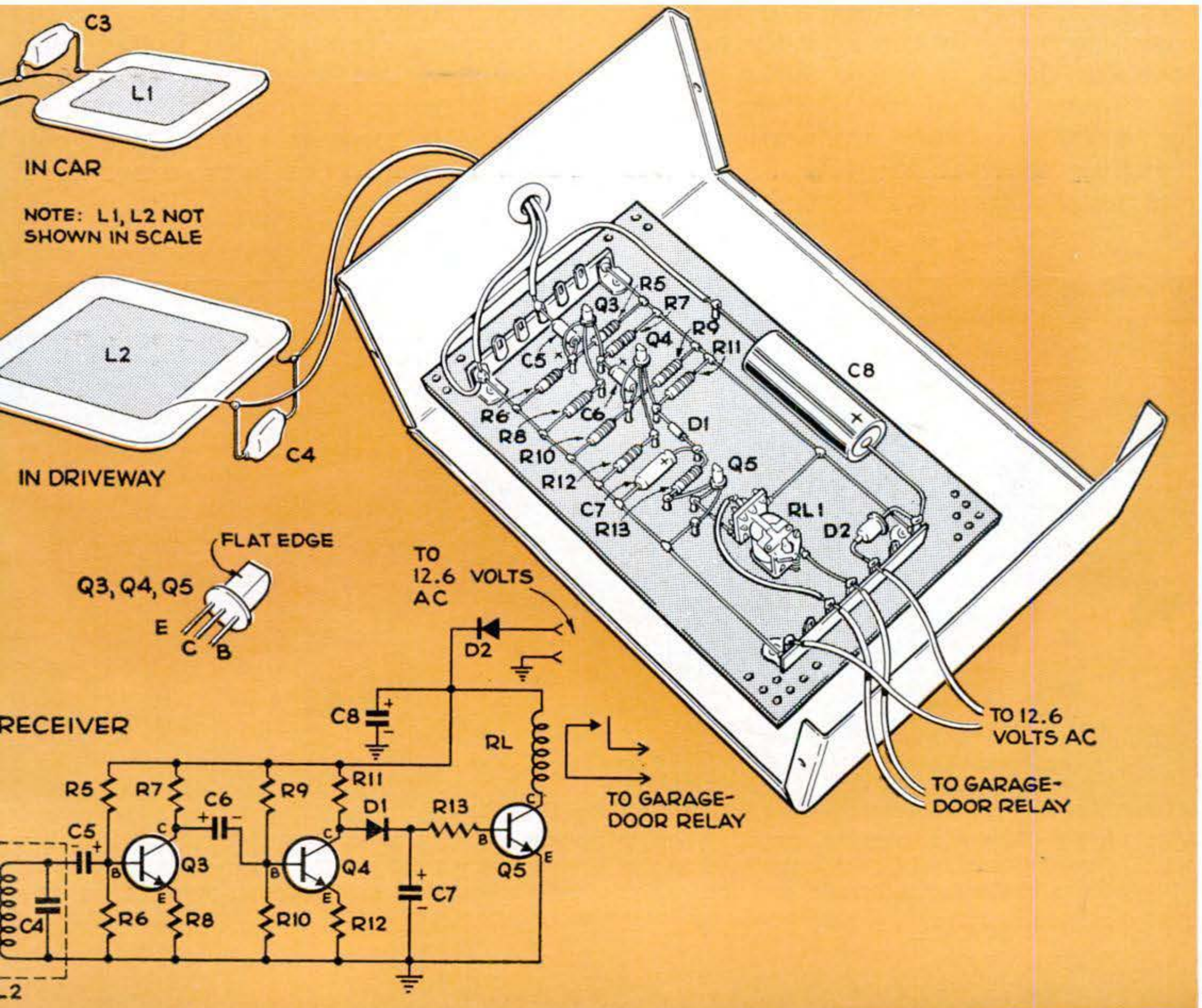


enamel-coated magnet wire (any gauge) wound on a six-inch-square form. Receiver coil L2 consists of 35 turns of the wire wound on an 18-inch-square form.

Wrap the coils with plastic tape for protection.

Capacitors C3 and C4 are shown away from the coils in the diagrams for clarity; they should be taped close to their respective coils, and protected from the moisture in the actual installation.

The receiver circuit is designed to be powered by 12.6 volts AC. If this voltage is available inside your garage-door mechanism, run a two-conductor cable to a convenient point on the mechanism's chassis. If not, use the filament transformer specified in the parts list. PS



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RIGHT OUT OF A SPRAY CAN—

Rattle-Free

By PHIL McCAFFERTY

WINTER WORKSHOP IDEA 22

Foam plastic in an aerosol can? You can buy it now. Out of curiosity I got some to fiddle with. The result: a custom-tailored, rattle-free toolbox for my set of car tools.

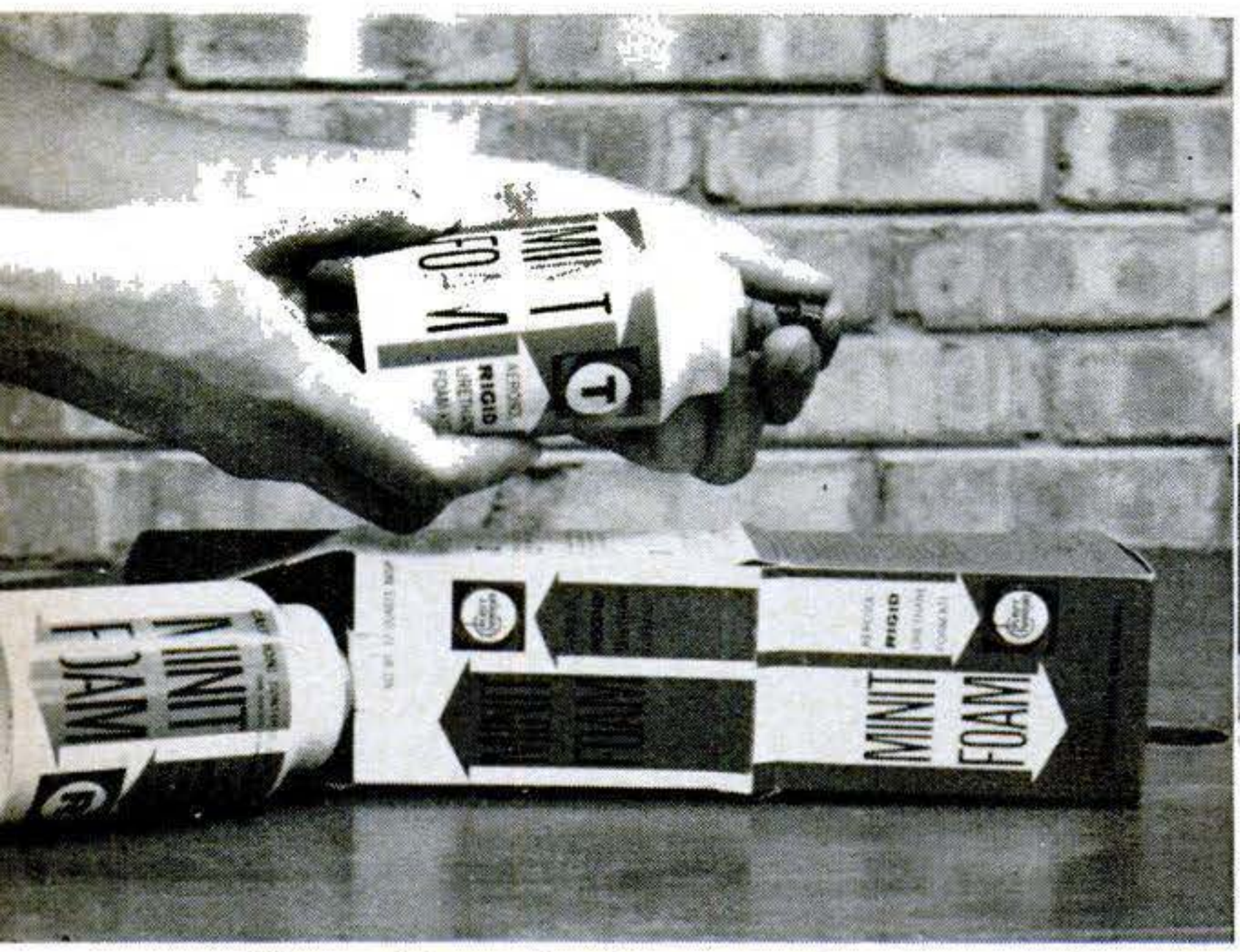
Called Minit Foam, the spray-can product keeps urethane in a liquid state until needed. The urethane and a catylyst come in separate aerosol cans, one on top of the other in a cardboard carton. When the two are mixed (by pressing the top of the carton), a brief shaking is all that's required. The result is a spray fluid that expands into millions of tiny air cells with rigid plastic walls. The stuff can fill 30 times its original volume.

To make the toolbox, pick a small tackle or utility box that will hold the tools you normally carry. If the box has sufficient depth, you can make two or more trays to hold tools. Make a form for each tray—with inside dimensions matching those of the box. If the box has rounded corners add triangular glue blocks to form the corners. To provide finger holes, glue two short lengths of ¾" dowel at each end on all forms.

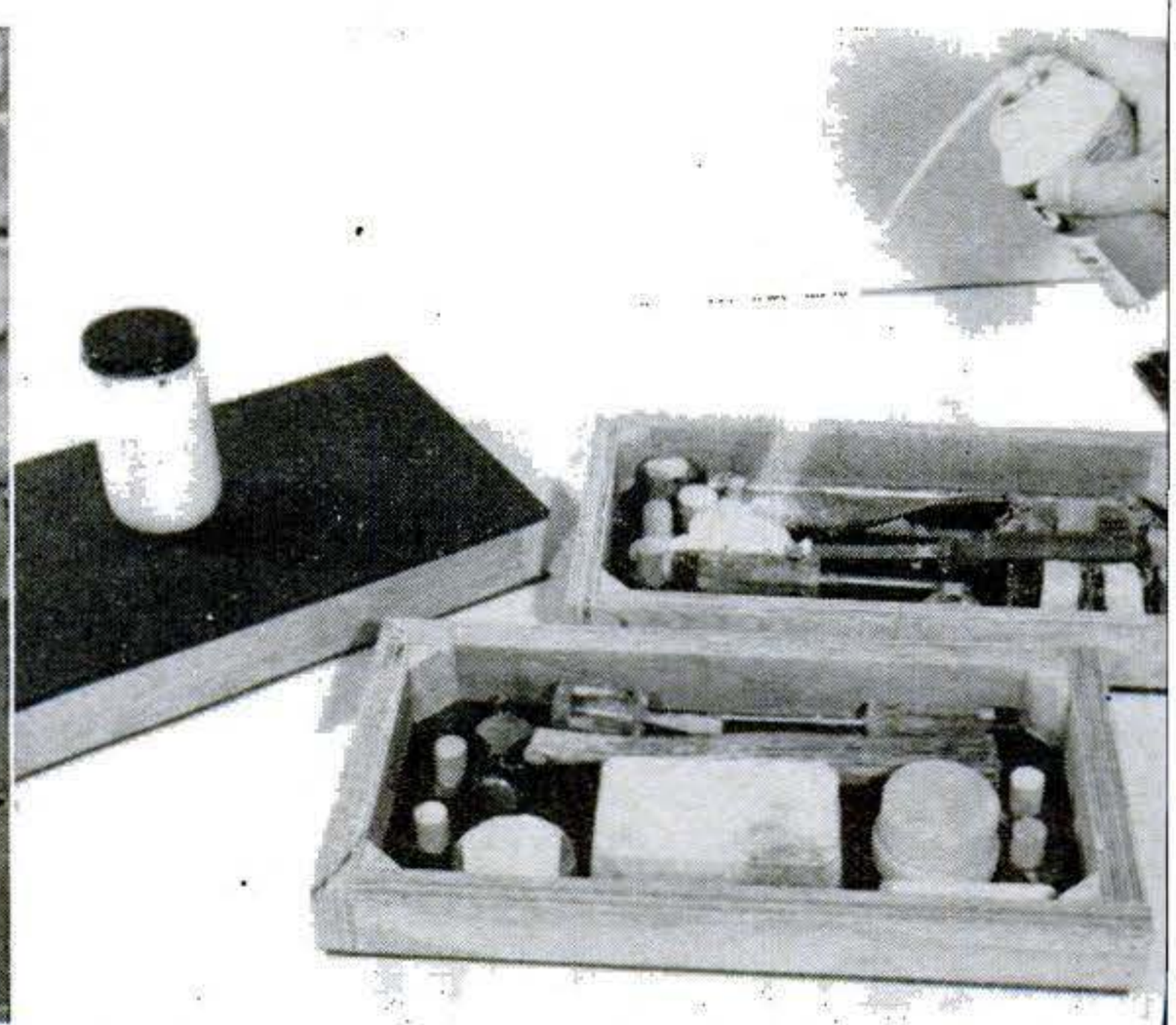
Make a trial arrangement of the tools in each form and, when satisfied, prepare them for the spray. Any tool that has an opening, plier jaws for example, should be covered with tape to keep the foam out. Small tools, nuts, screws, and the like are placed in a plastic bag which is then sealed. Finally, coat all tools generously with paste wax.

Wax the inside of the forms and place the tools in position. Tape down any small tools so that the foam action won't float them out of place.

Mixing the foam. You'll hear a "whoosh" a few seconds after you press the top of the carton to start the mixing process. But wait for the gurgling that starts about a minute later. When the gurgling stops, discard the top can and fit the spray head to the bottom one. Shake this can vigorously until it is warm—about a minute. From here on you have to move at a pretty good clip. The chemicals harden in the can in about five minutes.



After mixing, there's a gurgling sound. When it stops, separate cans and fit the valve head to the bottom can. Shake for a minute and it's ready.



Spray the trays evenly until almost half full; then cover with a weighted lid. Finger holes for removing trays are shaped with pieces of dowel in the trays.

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Case for Car Tools

Spray the forms evenly until they are not quite half full. Put a waxed lid on each, weighting it so that the foam will expand evenly. Let the forms stand for 24 hours; that's the time the foam needs to develop maximum strength.

Next day remove the forms and turn the trays up. With a sharp knife trim away any foam that has crept around and trapped the tools. And cut a recess in each tool pocket (for your finger) to make tool removal easy. If the tray fits the box too tightly, sandpaper the edges until they enter freely. The final step is to glue felt, or gasket material, inside the lid of the toolbox to keep the tools in the top tray from rattling against the lid.

Safety first. There are several safety precautions you should take. The kit should be used only in a well-ventilated area, and care must be taken that none of the chemicals get on skin or clothing. To be sure you handle the materials right, read the manufacturer's instructions before you start working with them. And keep the kit out of the reach of any children who might be curious about it.

The three trays I made used up one 12-ounce package of Minit Foam, which sells for $3.98. It may be available at your hardware store, or you can write Eric H. Carlson, Foam Products Specialist, at Kerr Chemicals, Inc., 1001 Northwest Highway, Des Plaines, Ill. 60017. There's also a six-ounce-size can that sells for $2.98.

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WINTER WORKSHOP IDEA 23

Inspired by FRANK LLOYD WRIGHT:

How to Pour a Fireplace

Doing it is simple: Place flat rocks against the form, clean excess concrete off rocks later

By DARRELL HUFF

One of the many things the brilliant architect Frank Lloyd Wright taught us is that magnificent masonry walls and fireplaces can be built by unskilled hands.

Wright's famous Phoenix headquarters, Taliesin West, is a riot of colorful desert rocks nested in gray concrete. The technique is simply one of placing flat-faced stones against the forms before the concrete is poured. No skill is needed.

By combining this method with a steel circulator core, any man can pour his own fireplace. The result is an unusually handsome one.

As a heating device, a circulator fireplace is not merely as good as an expertly built all-masonry one; it is better. When your fire heats up the hollow steel core, cold air is sucked in, warmed, and ejected into the room.

The fireplace in the pictures is one I built into the corner of my living room. For the outside form I used lumber. The steel circulator itself, properly padded with the mineral wool that comes with it, acted as the inner form.

During the pouring I slipped in flat-faced rocks, placing them against the form boards so that they would be exposed later. Mostly I used rocks as big as I

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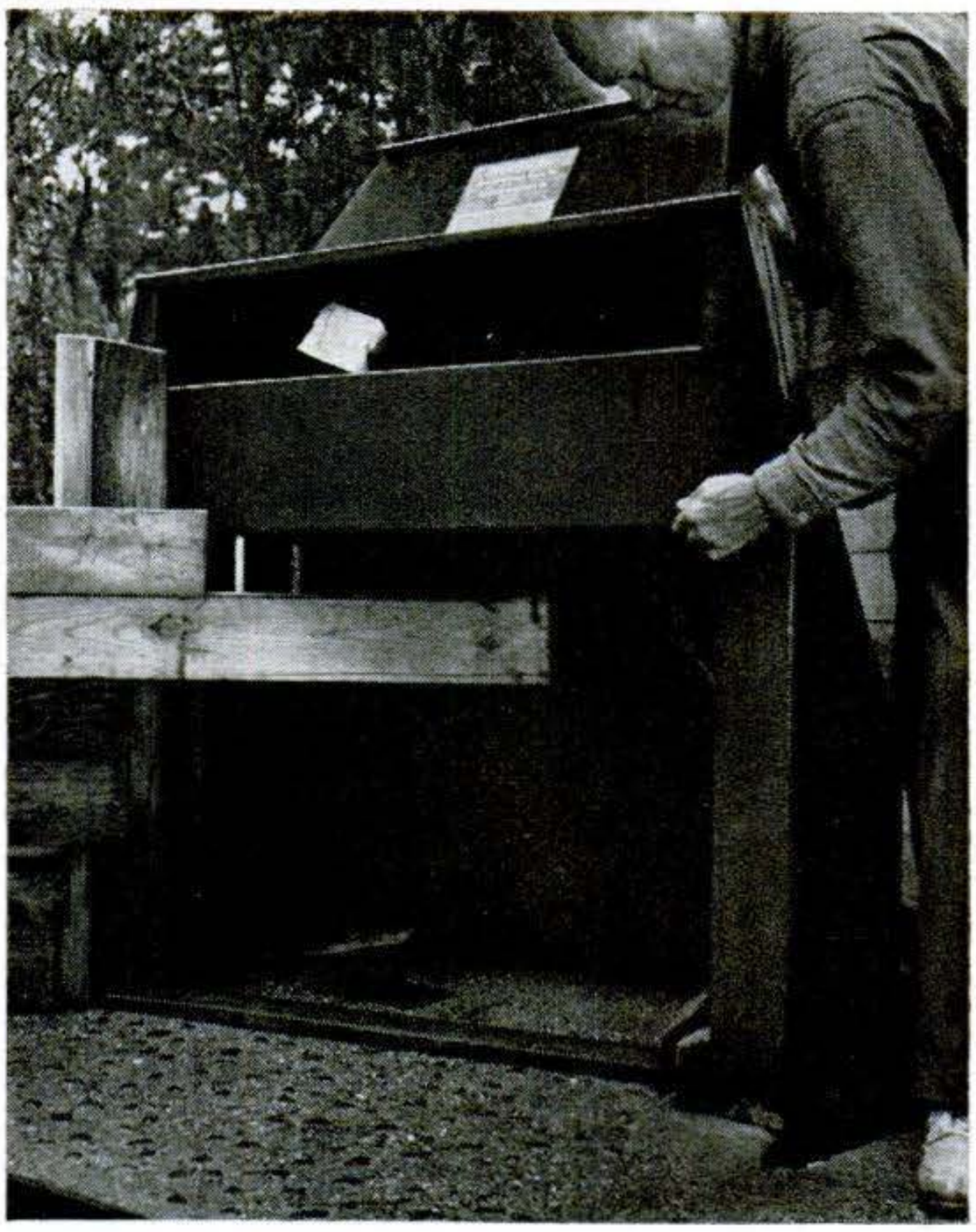
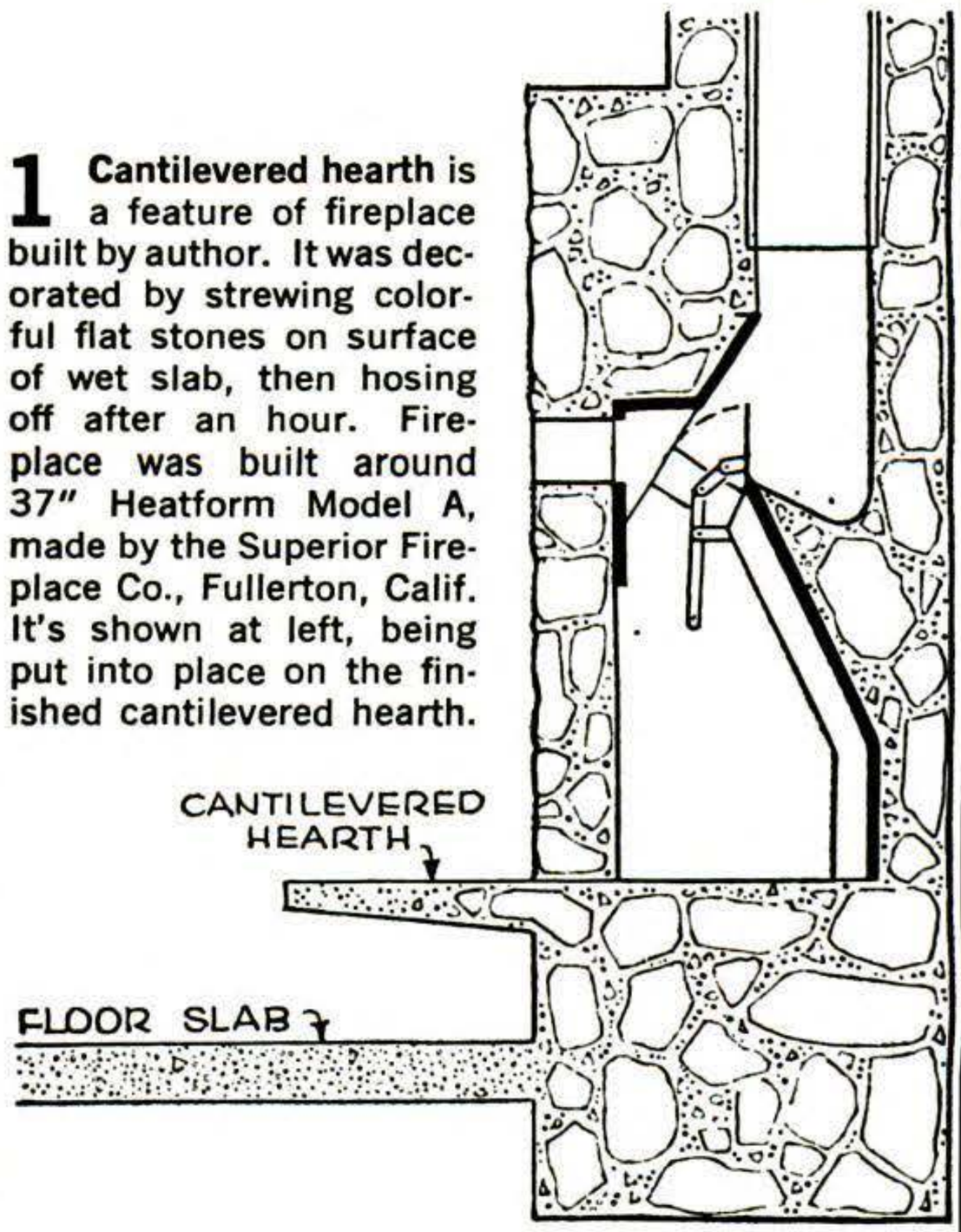


1 **Cantilevered hearth** is a feature of fireplace built by author. It was decorated by strewing colorful flat stones on surface of wet slab, then hosing off after an hour. Fireplace was built around 37" Heatform Model A, made by the Superior Fireplace Co., Fullerton, Calif. It's shown at left, being put into place on the finished cantilevered hearth.



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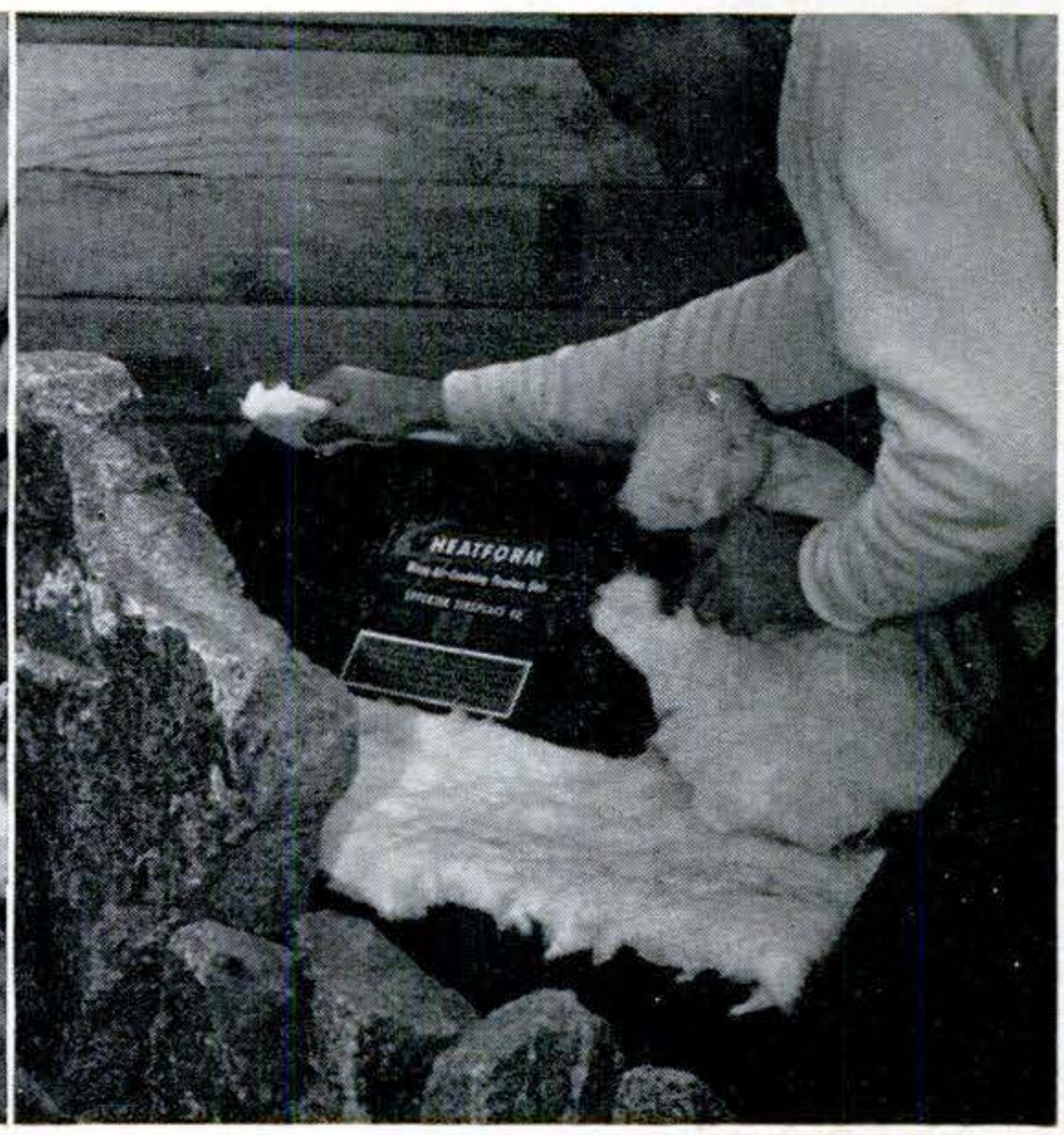

2 **Air ducts,** from openings in metal form to surface of masonry, can be shaped with several bricks or flat rocks. Note reinforcing rods used.

3 **Before concrete is poured** a buffer of mineral wool must be pasted with cement and water to outside of steel unit to let it expand when heated.

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Rocks and cement—here's how you put them together

could handily lift. To place one very heavy and showy rock directly over the fireplace opening, I used a small hoist.

I reinforced the concrete liberally with standard ½″ steel rod. This gave me a fireplace wall so strong that my building inspector unhesitatingly accepted it for structural purposes. It supports a main beam and the upper wall of my two-story house.

In the upper part of your fireplace you'll find places where the wall is thicker than necessary. You can use this space (and save concrete) by casting in niches or cupboards, forming them with boards.

A poured-concrete fireplace and chimney can be given an even more rugged look by treating the surface in the manner of an exposed-aggregate patio slab. The technique is to pull off the forms as soon as the concrete is stiff enough to stand alone and hose down the surface.

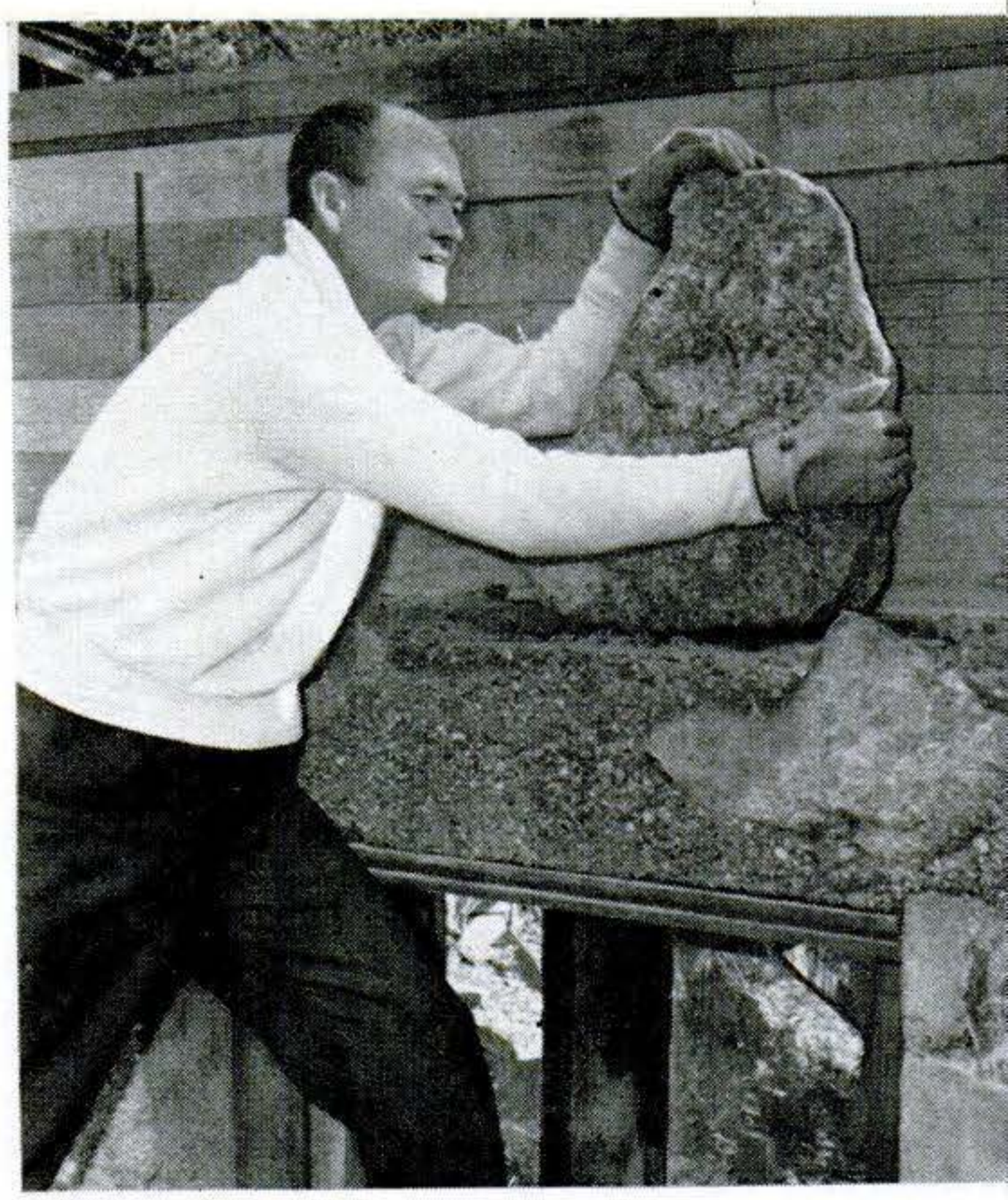
A Swedish fireplace. You can also make yours what is sometimes called a Swedish fireplace by casting the base and hearth to a level about 16″ higher than the floor of the room. Such a fireplace is easier to fuel and to cook over, and it throws its heat more effectively. But remember that cool-air intakes should be as close to floor level as possible and that if your hearth is cantilevered it should be heavily reinforced with steel rods running both ways.

A gas kindler will add enormously to the utility of your fireplace at a cost of only a few dollars. Various types are available from dealers and from the maker of the fireplace unit.

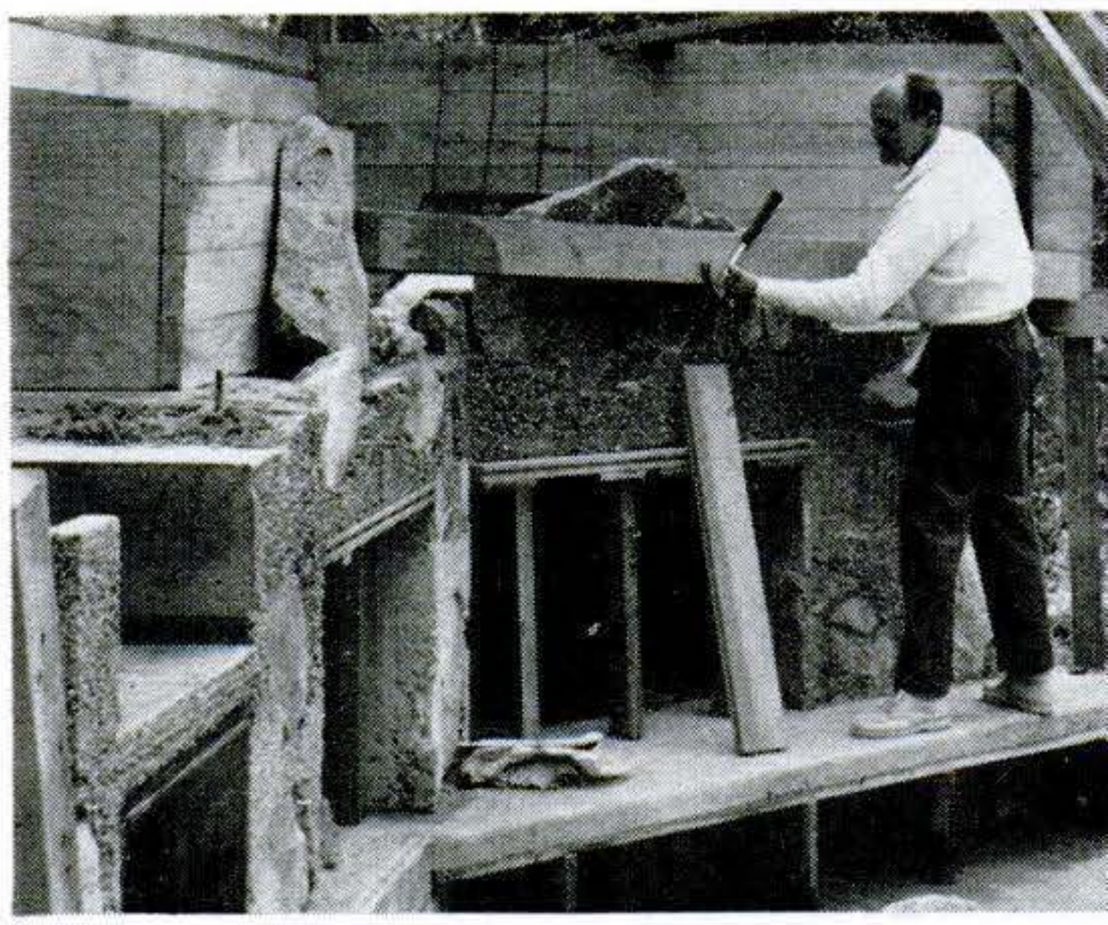
Details of your fireplace such as working dimensions and measurements and flue sizes and chimney heights naturally vary with the size of the unit you choose. These figures can be found on the instruction sheets that come with the circulator units. Here are the general principles to follow in pouring your fireplace:

1. Excavate to frost line and pour a concrete foundation slab and hearth. Make the hearth generous—at least 24″ from front to back and 24″ wider than the fireplace opening. Plug in lengths of

[Continued on page 174]

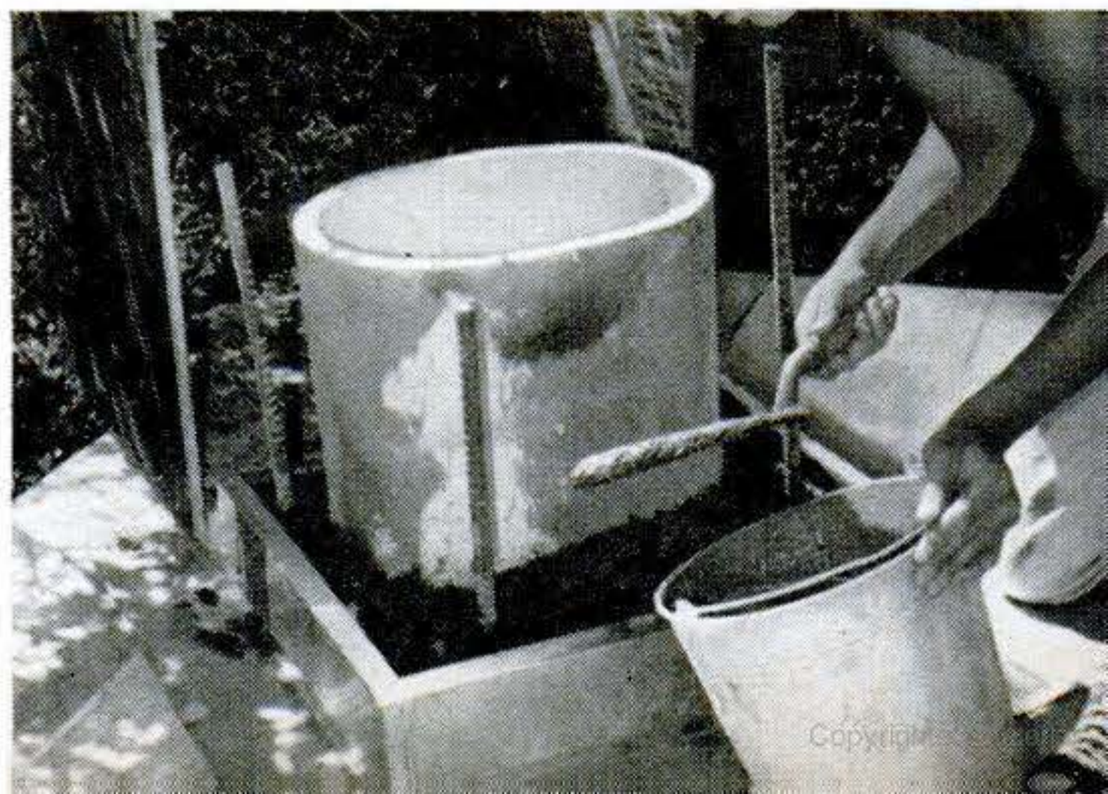


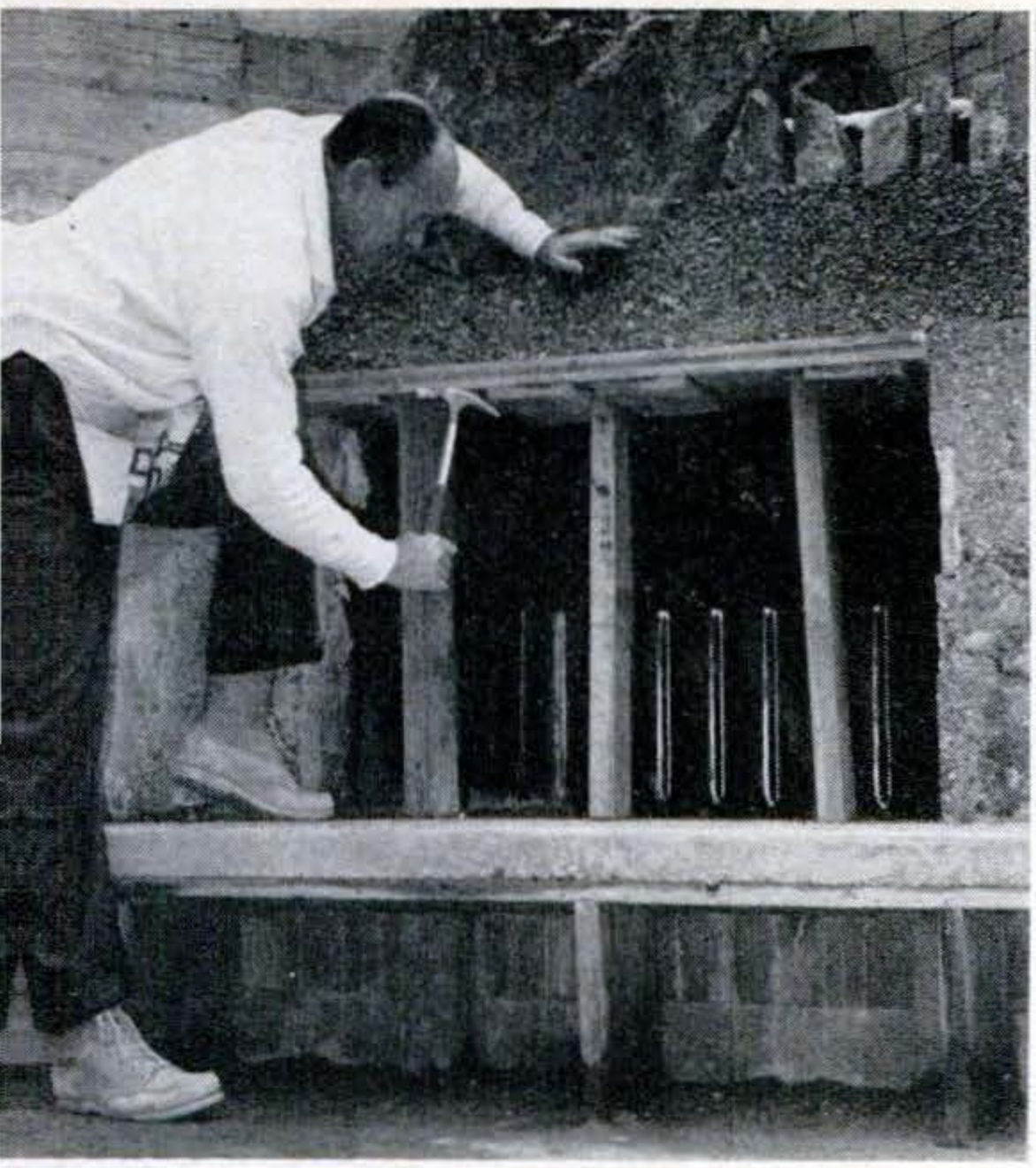
4 **Heavy rocks** are more easily placed before form is completed. Opening seen here is for an optional feature—a wood-storage box opening outdoors.



7 **Forms are being completed** to top of fireplace. Angled opening at left is for a barbecue; box above it is form for cupboard opening to outdoors.

10 **Sheet-metal flashing** surrounds chimney forms, brought to 4″ above roof deck. Concrete is being packed around it in photo below.





5 **Form work** for cantilevered hearth and fireplace opening is shown here. Spaces between stones mortared in at upper right are for warmed air.

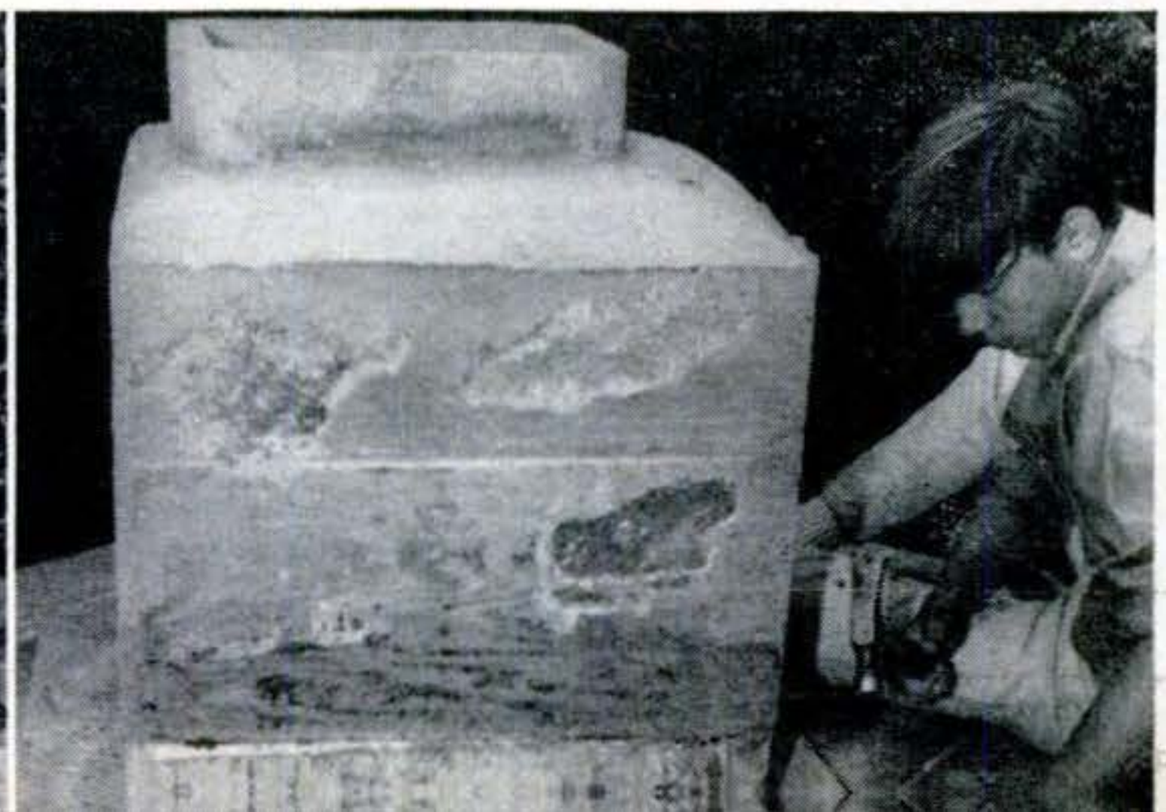
6 **Wire brush cleans off cement** that seeps over faces of rocks. Rough texture of concrete was produced by pulling forms early and hosing surface.

8 **Smoke shelf** slopes downward slightly from back of opening at top of steel unit. Shaped as in Heatform data sheet, it discourages downdrafts.

9 **Chimney forms** around flue liner are pieces of plywood lightly fastened with form nails and tightly clamped. Chimney is for a two-story house.

11 **Last touches** are being given to top of chimney. Note plywood chimney forms. Protruding flue top lessens danger of fireplace smoking.

12 **Flashing is nailed** to roof deck. Part of chimney exposed to view can be made better looking by inserting rocks while pouring concrete.



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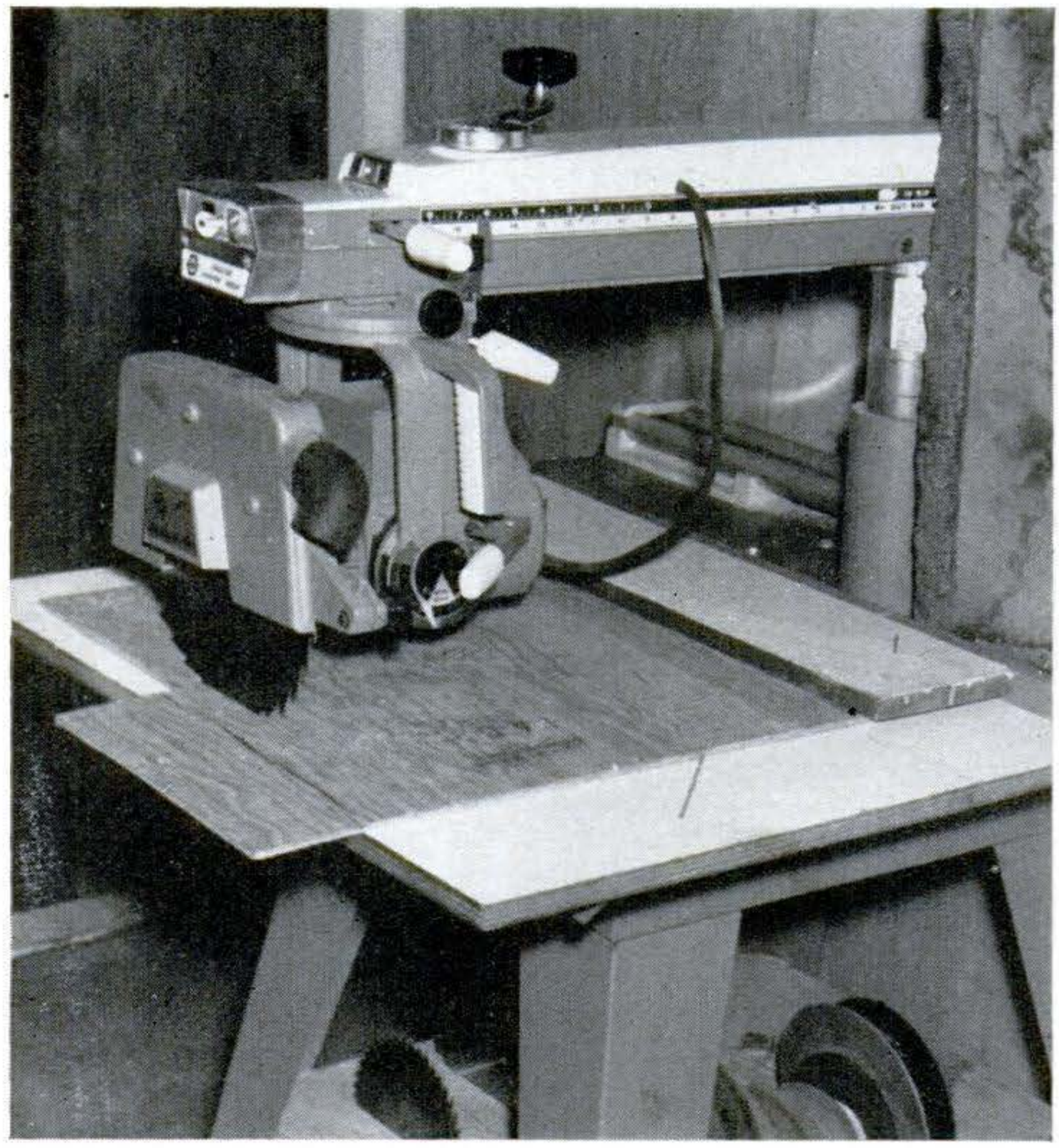
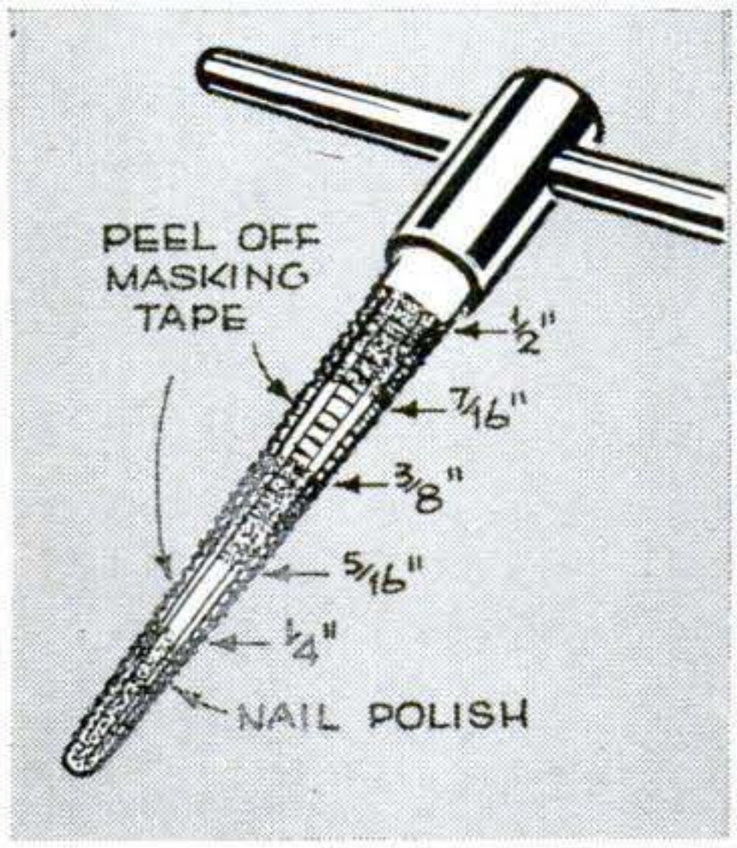
7 Good Shop Ideas



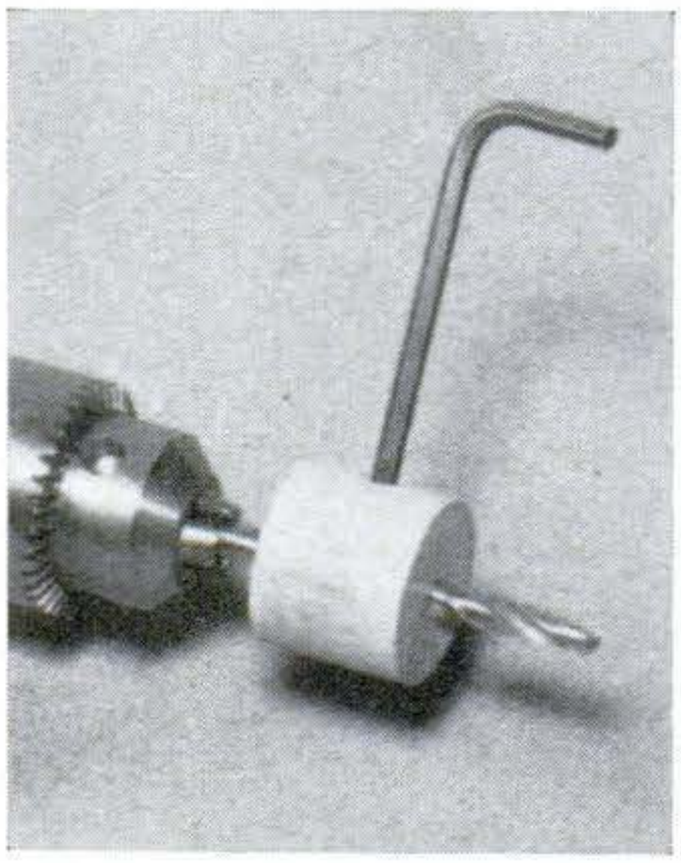
WINTER WORKSHOP IDEA 24

An out-of-square board or piece of plywood is just about useless for bench- or radial-saw operations until you true one side. Here's the easy way to do it: Tack a board with a true edge to the material to be cut, letting it overhang the workpiece by at least ¼". Then butt the true board against the rip fence, and cut. After the first pass (note L shape being cut off plywood in photo left), you're back in business. For heavy stock (walnut slab in upper right corner) clamp one-by-four stock to the rip fence to butt the work against. A bench-saw fence, being higher, does not need the "helper" fence.



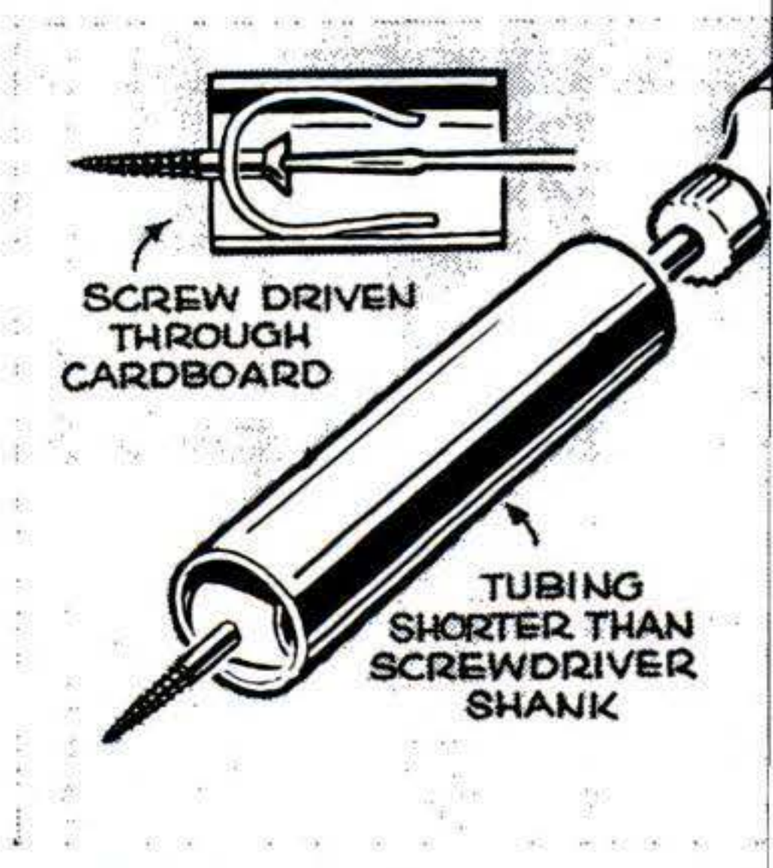
WINTER WORKSHOP IDEA 27

When reaming for a particular size hole, there's no need for trial and error. Painted rings around the lands from ½" down to 7/16", 3/8" to 5/16", and ¼" to the end remove guesswork. All you need is masking tape, razor blade, and nail polish. The enamel wears off the cutting edge but stays in the lands. Since the reamer is lineal, you can estimate to 1/32" by using a point halfway between marks.



WINTER WORKSHOP IDEA 28

Here's a depth stop that is easy to make. With the bit you are going to use, drill a hole through the center of a short piece of 1" hardwood dowel. Then tap one side for an Allen setscrew. If you don't own a regular tap, the threads of the setscrew will cut their own in a predrilled hole. Mark the bit size on the stop, and set it aside for future drilling jobs.



WINTER WORKSHOP IDEA 29

To start screws in hard-to-reach places, take a piece of tubing (into which the screwdriver blade will fit) and cut a piece shorter than the shank. Turn the screw through a strip of cardboard wider than the screwhead. Bend the cardboard, place it in the tubing, and slide it along with the screwdriver. The cardboard holds the screw straight; it breaks away when the screw is driven home.

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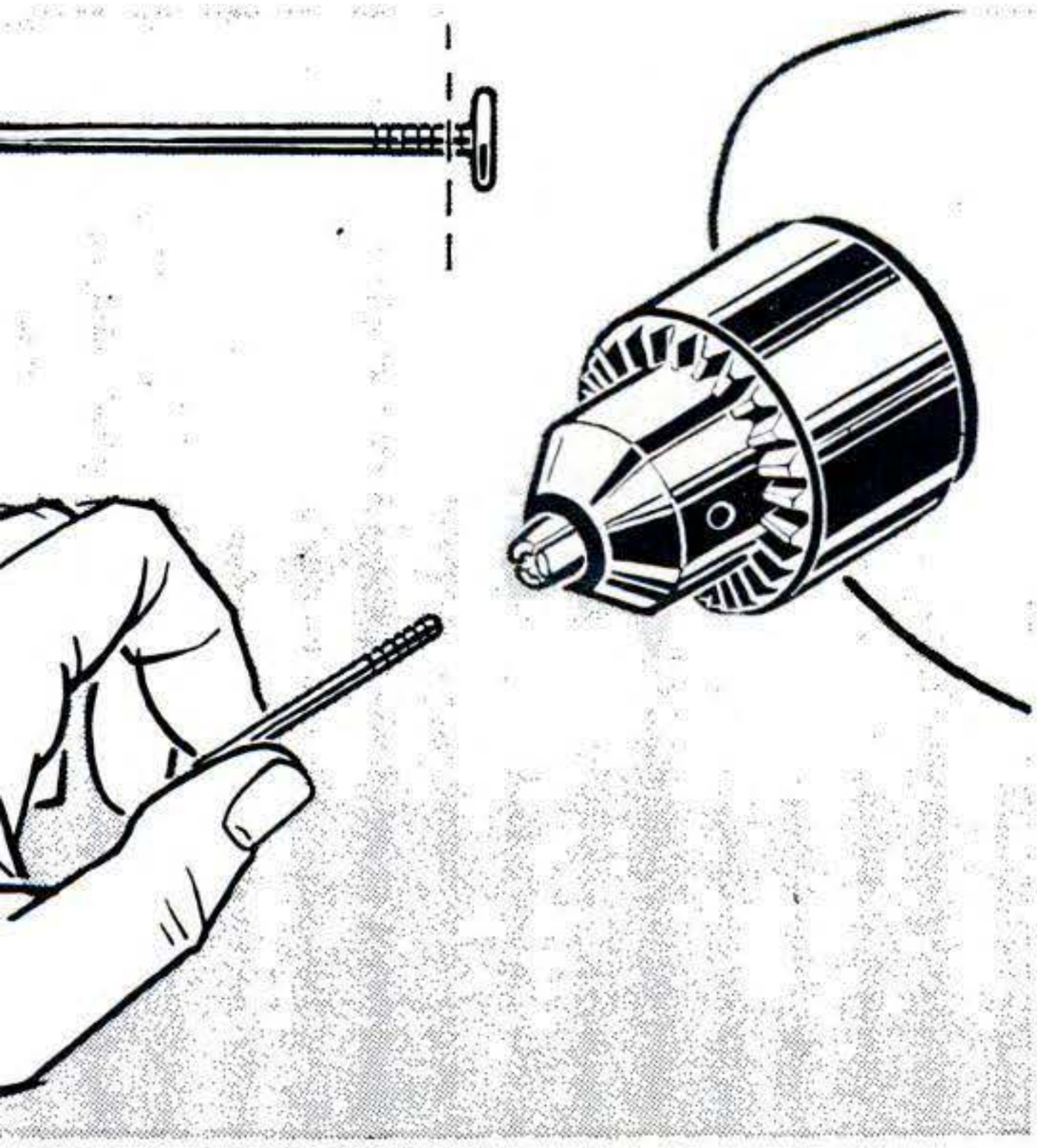
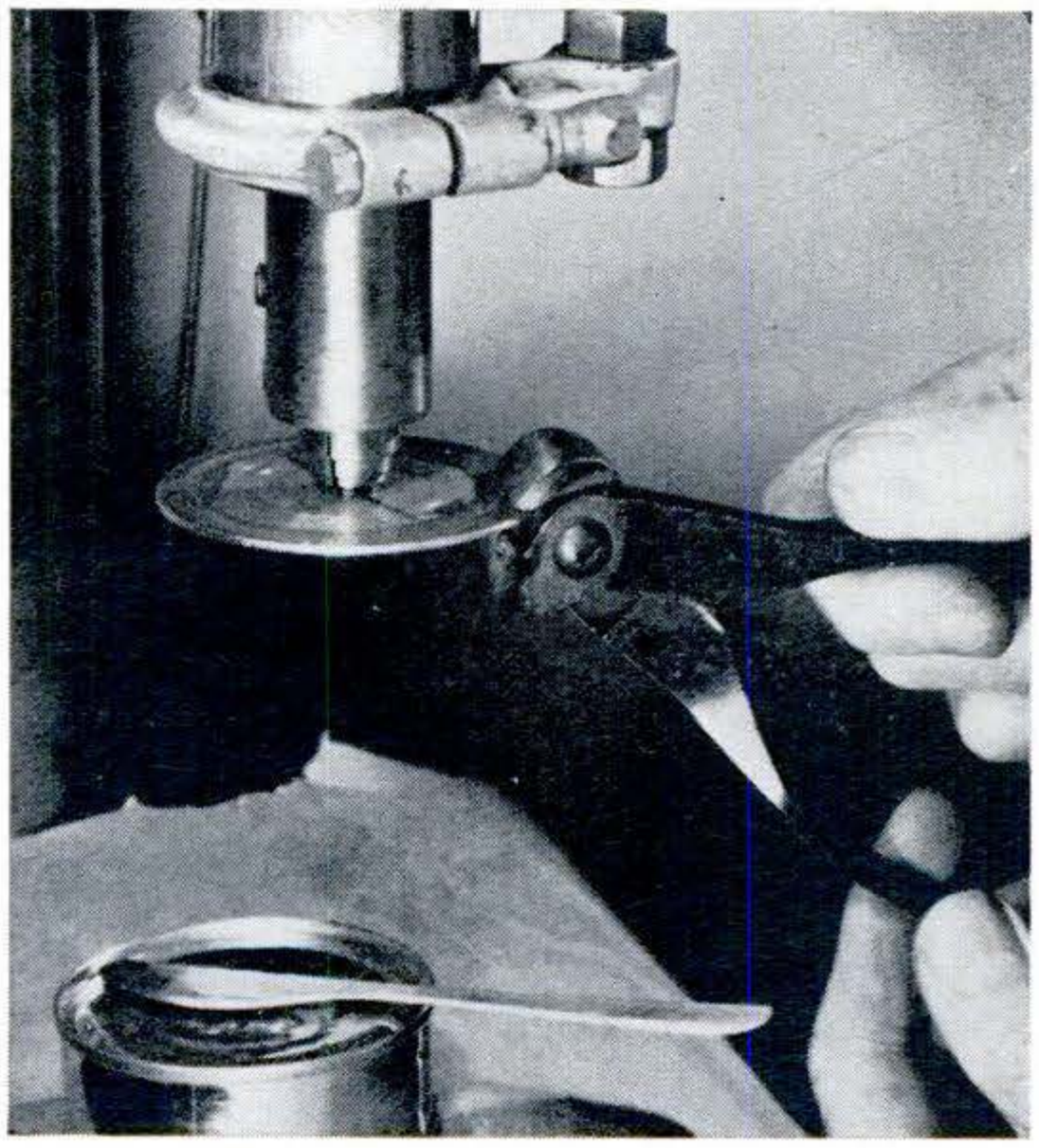
Others Have Used



WINTER WORKSHOP IDEA 25

Predrilling is often necessary to prevent splitting when you join boards with nails. It also makes the operation easier and faster. But finding the right-size bit for the job takes time. Instead, clip the head off one of the nails to be used, chuck it in your drill, and use it as a bit. You'll have the right-size hole.

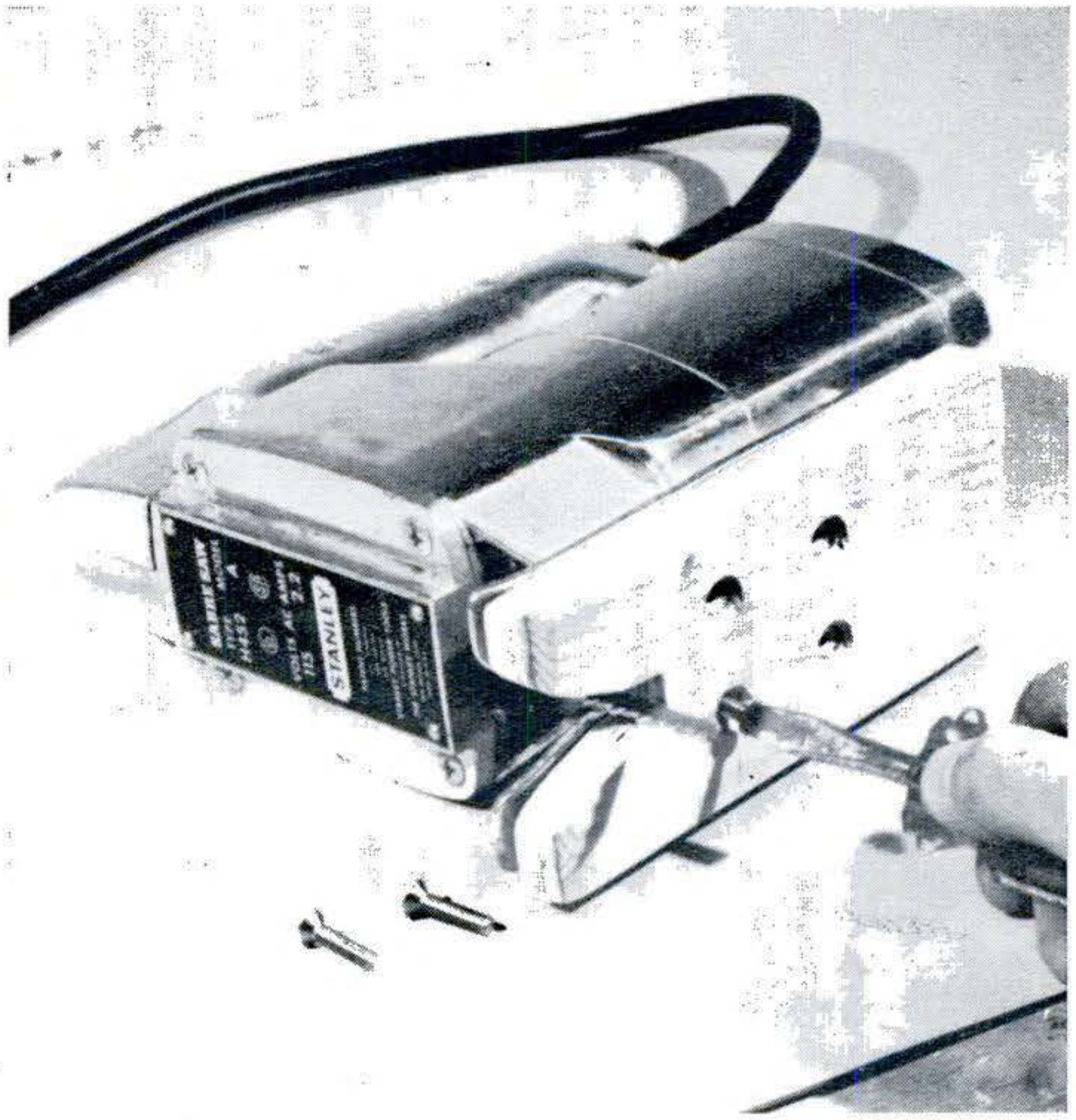


WINTER WORKSHOP IDEA 26

End-cutting nippers don't have to be taken apart to true the jaws or renew the edges. Recondition them with an arbor-mounted aluminum disk charged with abrasive grains and oil. Make sure the disk is thick enough to resist bending, and be careful to turn it at a slow speed that won't sling the mixture off.

WINTER WORKSHOP IDEA 30

Saber-saw blades that break at the shoulder are still usable if you file several teeth off (above) at that point until the blade fits in the saw. You can also extend the useful life of blades by temporarily adding a piece of ½" stock to the bottom plate (right). This will bring new teeth into play. Countersink screw holes and sand the bottom smooth with an upward curve at the front.



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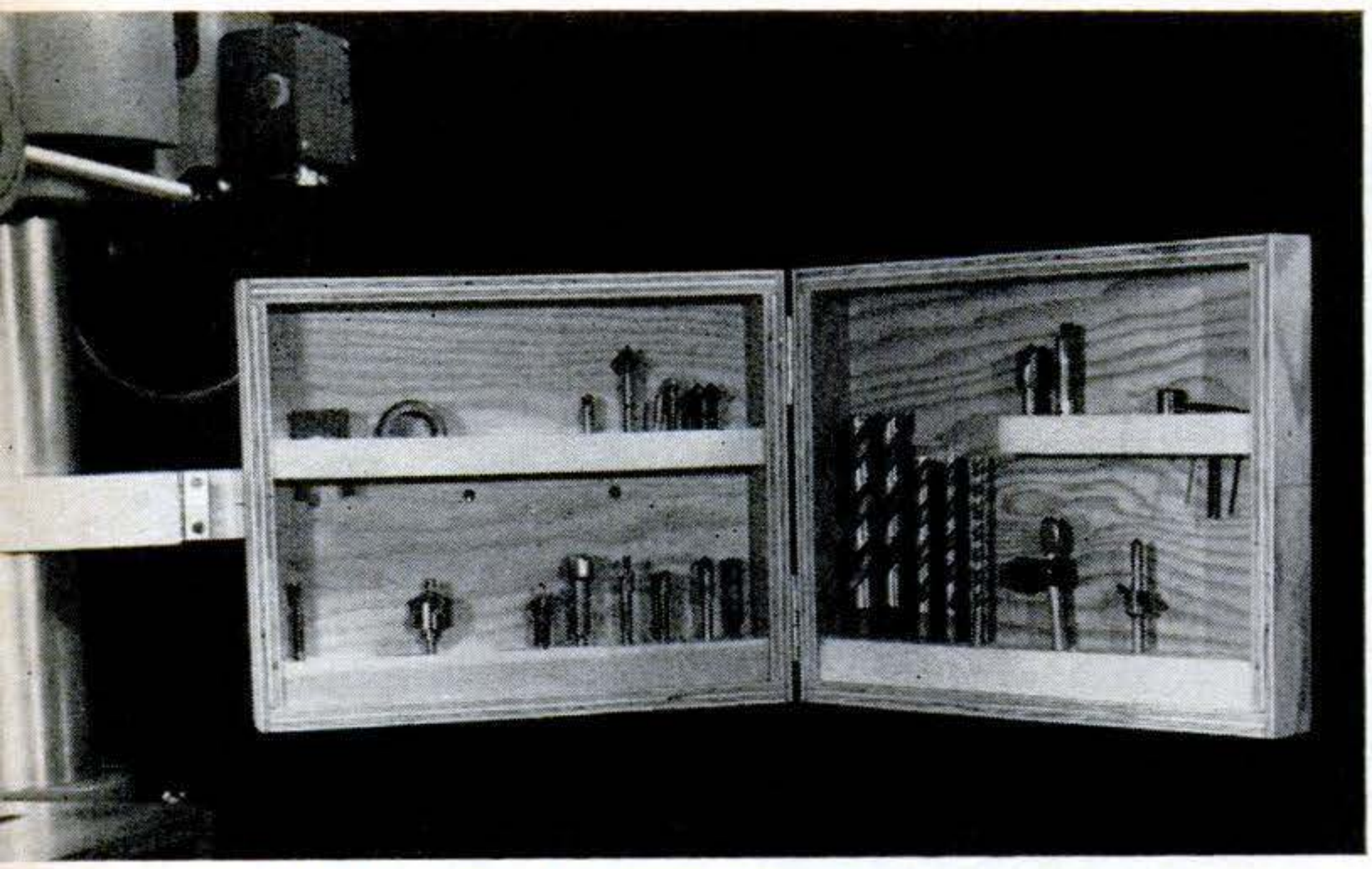
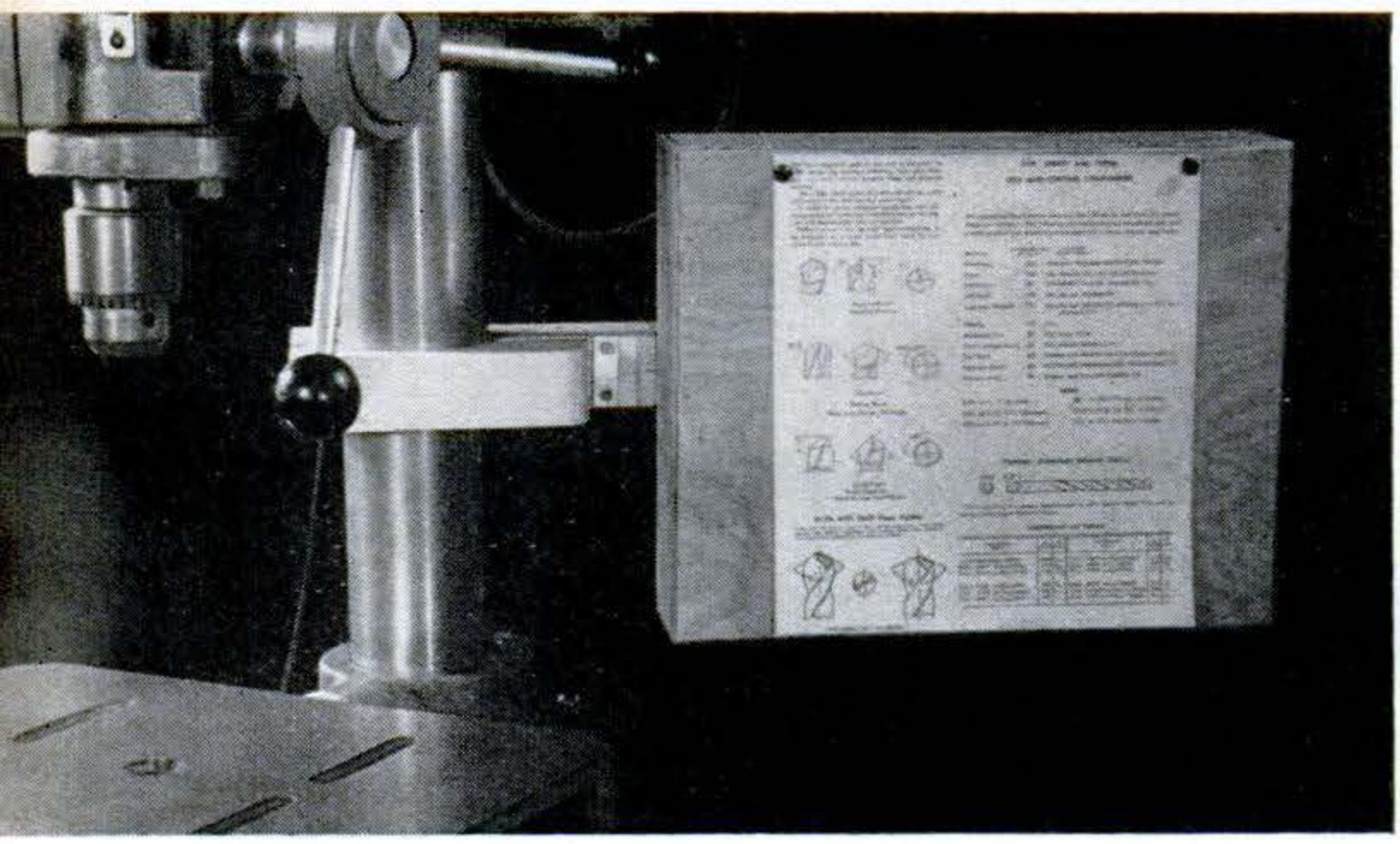
3 Good Accessories

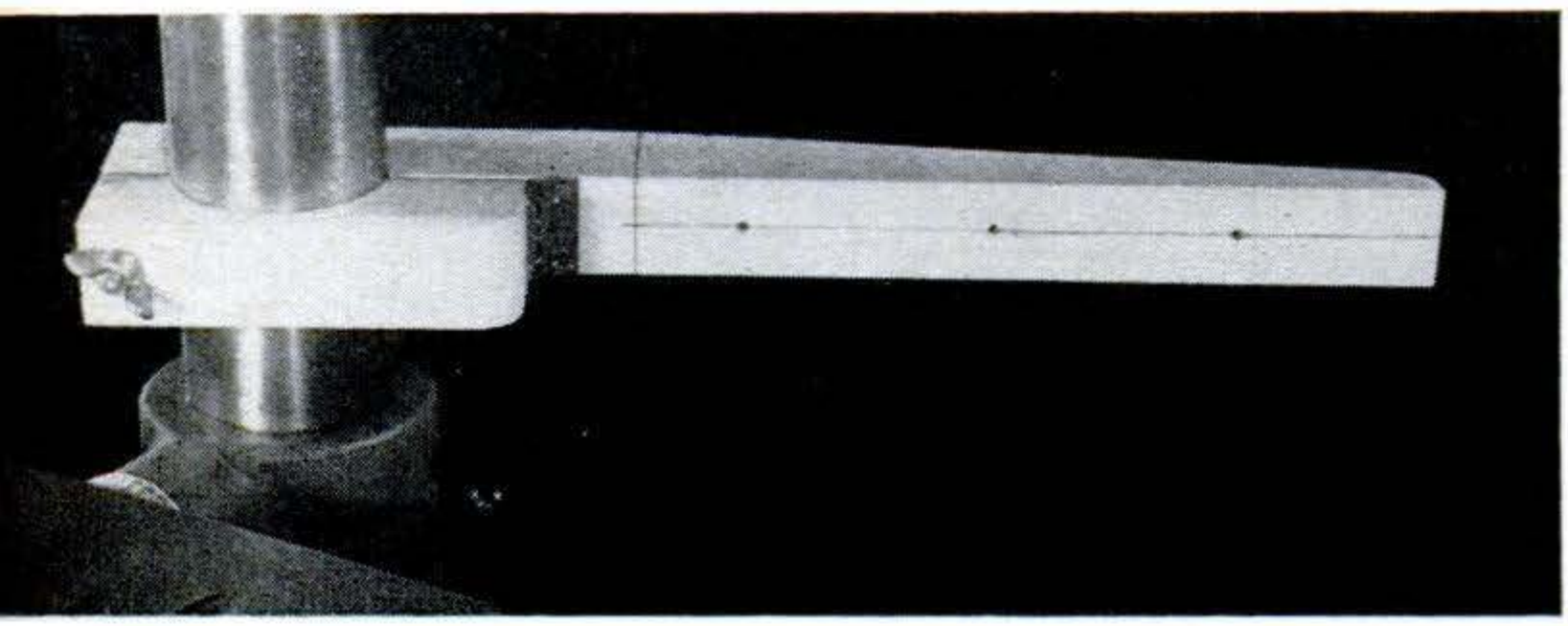
By R. J. De CRISTOFORO



Case has space for many small tools, but don't outfit it haphazardly. Instead, lay out all small tools that you use frequently and design the holders to use the space efficiently.



With case closed, tools are kept dustfree. A small hook will keep it shut. Outside of case is handy for reference data.



Support arm is simple but stable. A turn of wingnut loosens the arm so it can swing 360 degrees or move vertically.

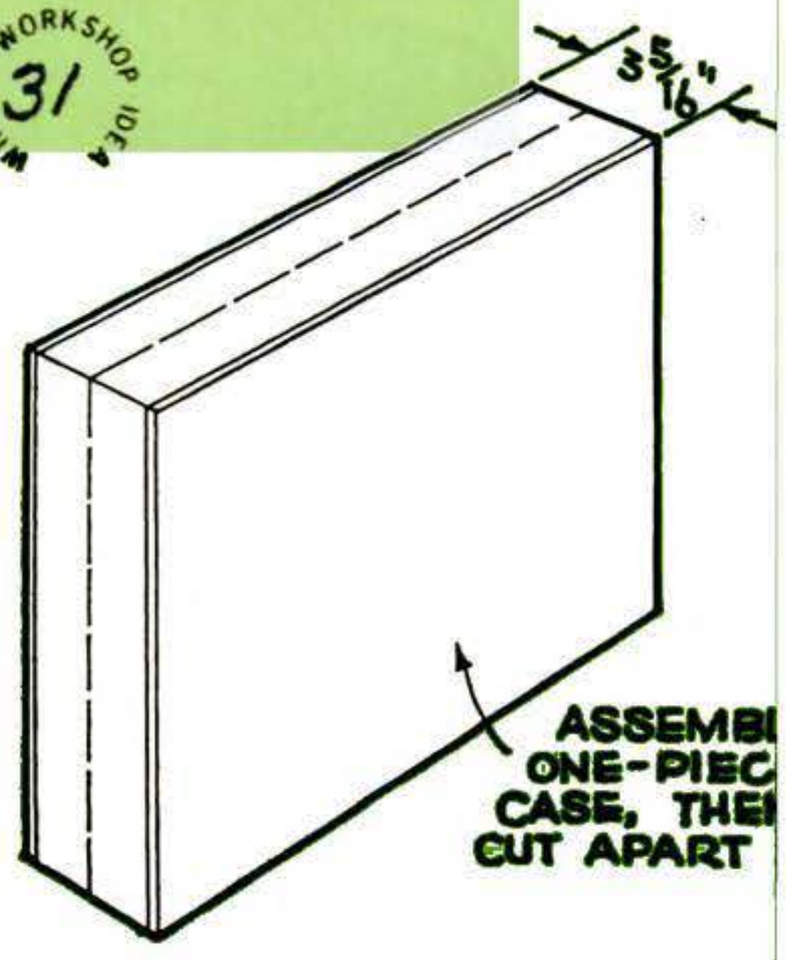
Your drill-press work will be easier, if you keep frequently used tools close at hand so you don't have to walk, stretch, or stoop every time you need one. That's the objective of the storage case shown at left. It is not a substitute for a large cabinet, but if you analyze your work and outfit the case to suit your needs, you'll find it a big help.

The auxiliary tables serve a dual purpose. They are instantly available setups for drum-sanding and they are handy tool shelves when work is being done on the regular drill-press table. The one-piece table is more convenient for a small drill press, the split table for a larger model. But it would be easy to scale either one to suit your equipment.

Continued

STORAGE CASE

WINTER WORKSHOP IDEA 31



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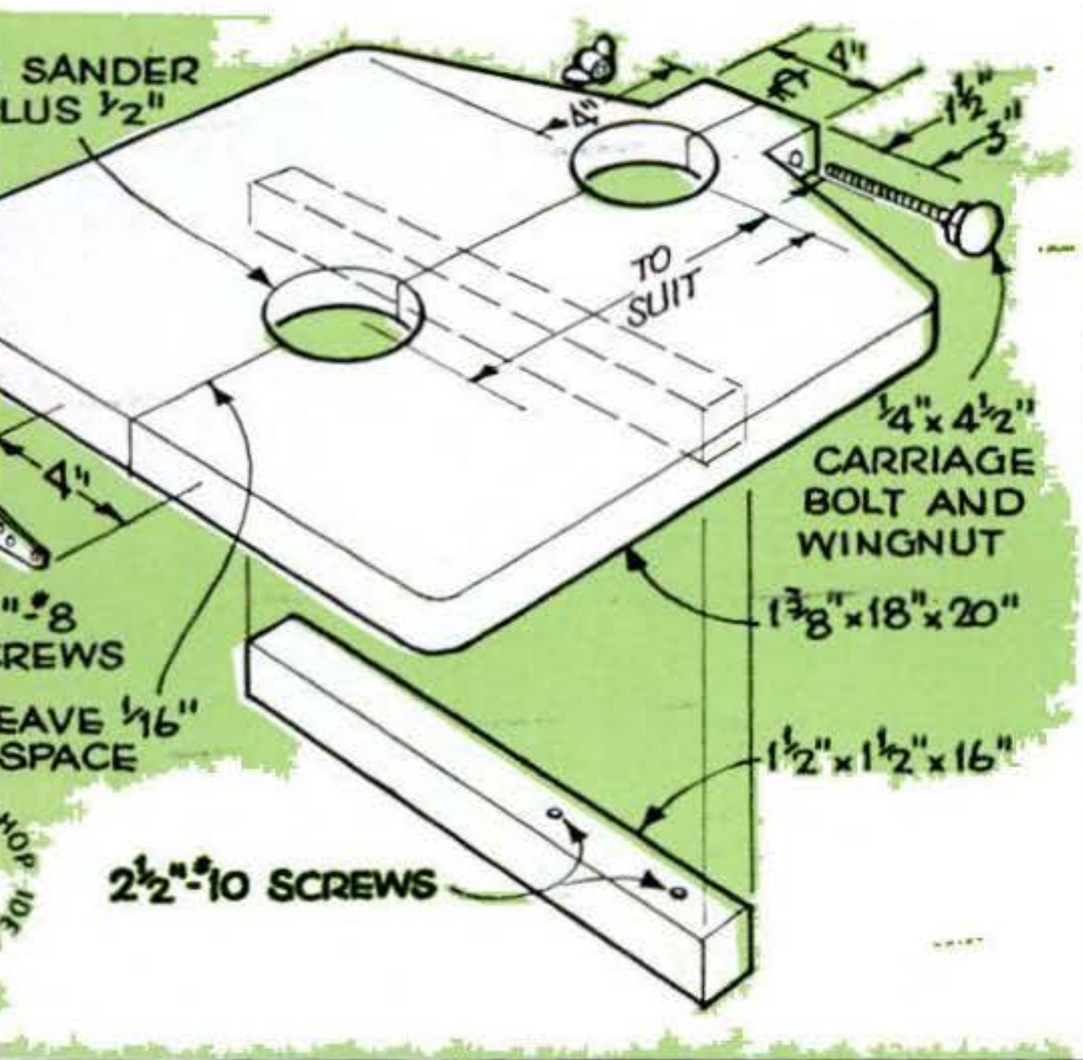
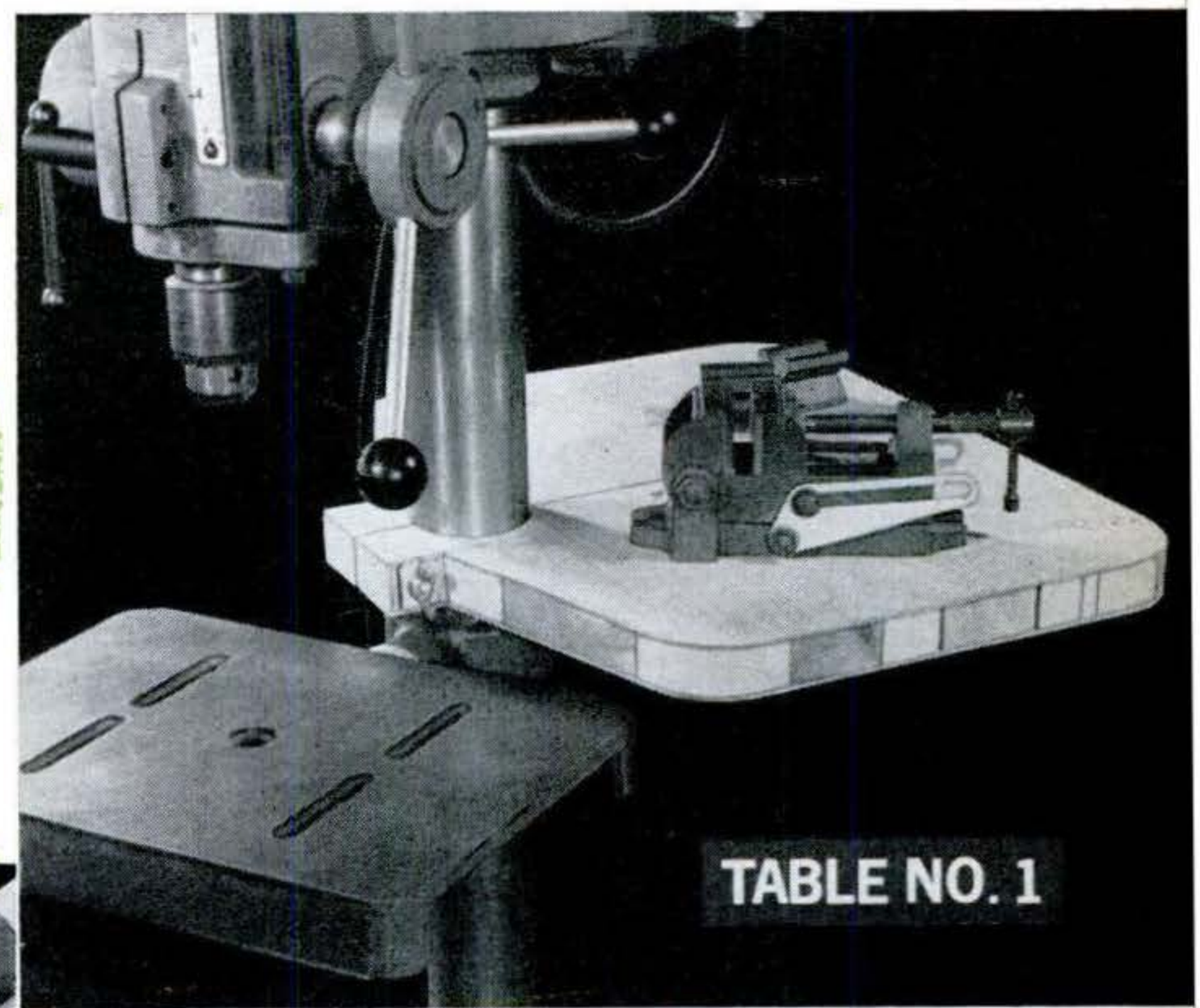
or a Drill Press





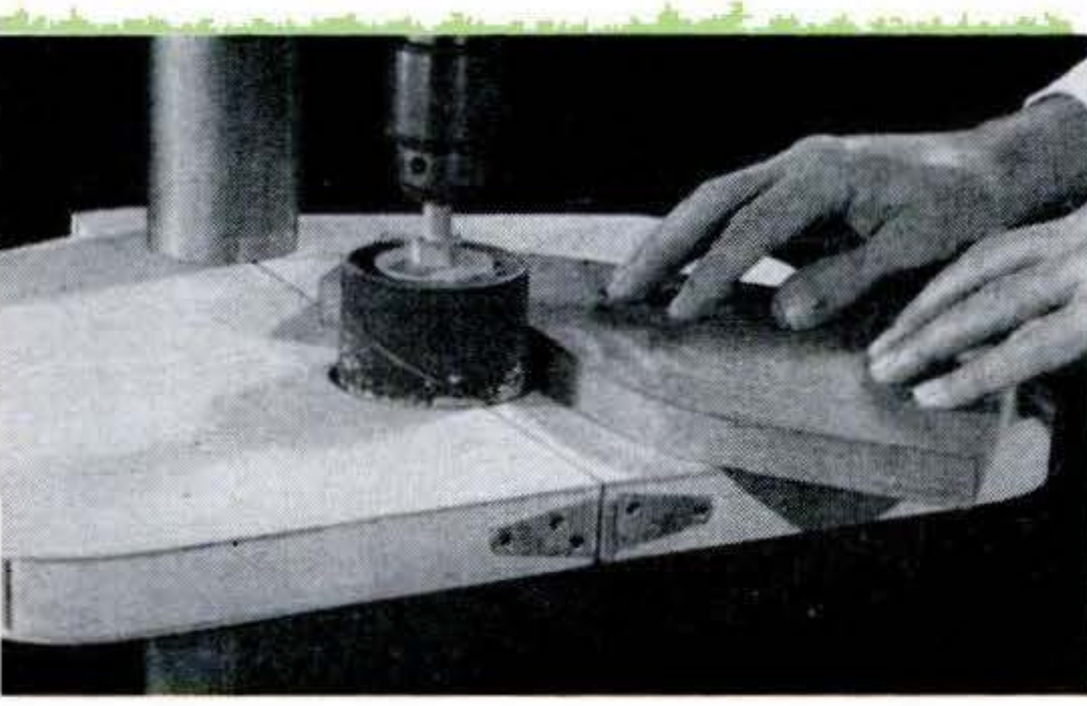
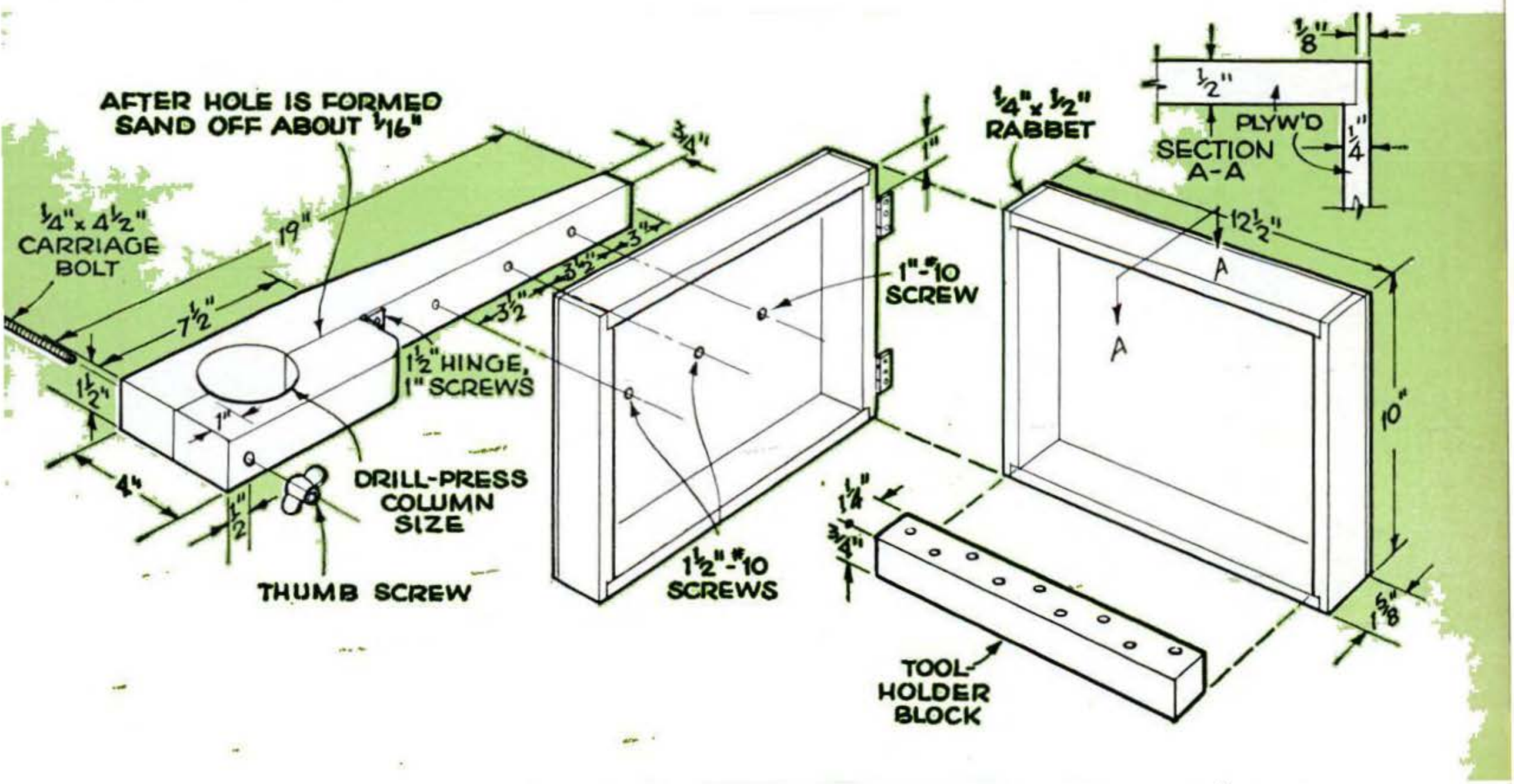


Table was formed in one piece before being split down the middle. Material used was a cutout from a solid-core door. Situation above could be reversed —regular table swung back to serve as tool holder. Table is fine for drum sanding—you can use the full width of the drum and keep edges square. Larger table is handy, too, when working large stock. Regular table can be placed to provide extra support.



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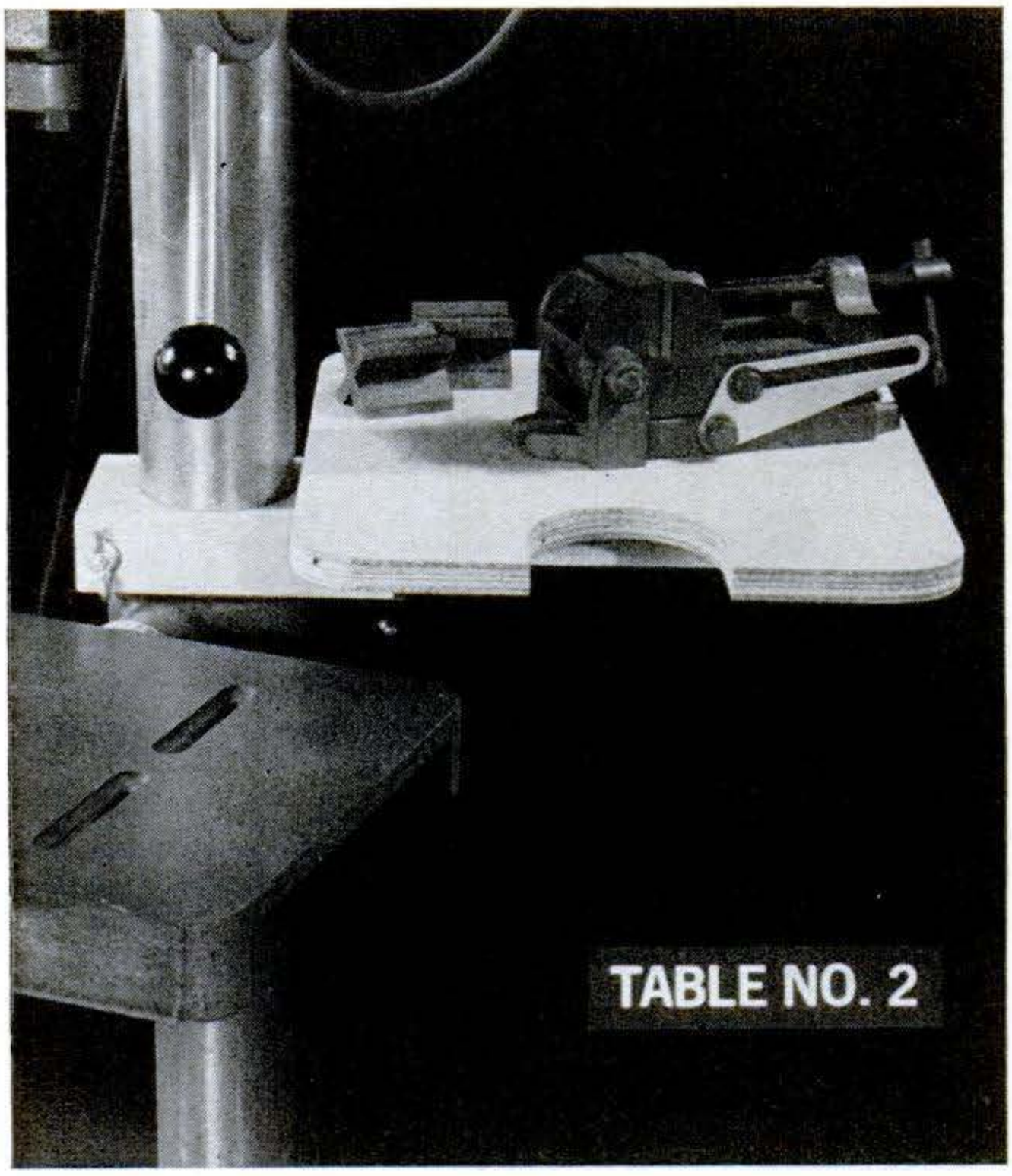
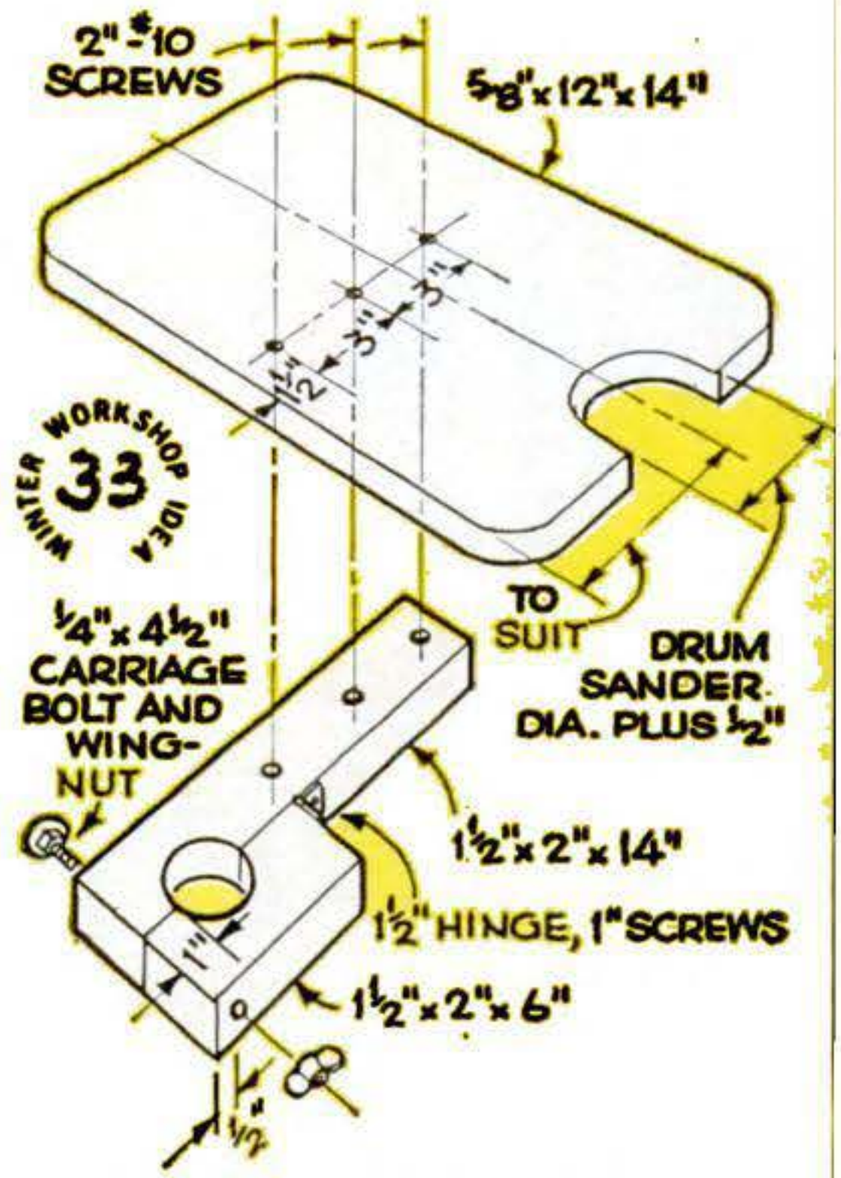
Tables and case are attached with a split-clamp arrangement. A turn of a wingnut enables you to position the accessory anywhere, vertically or horizontally. You might mount both a case and a table. This would not critically reduce the minimum distance between the spindle and the standard table.

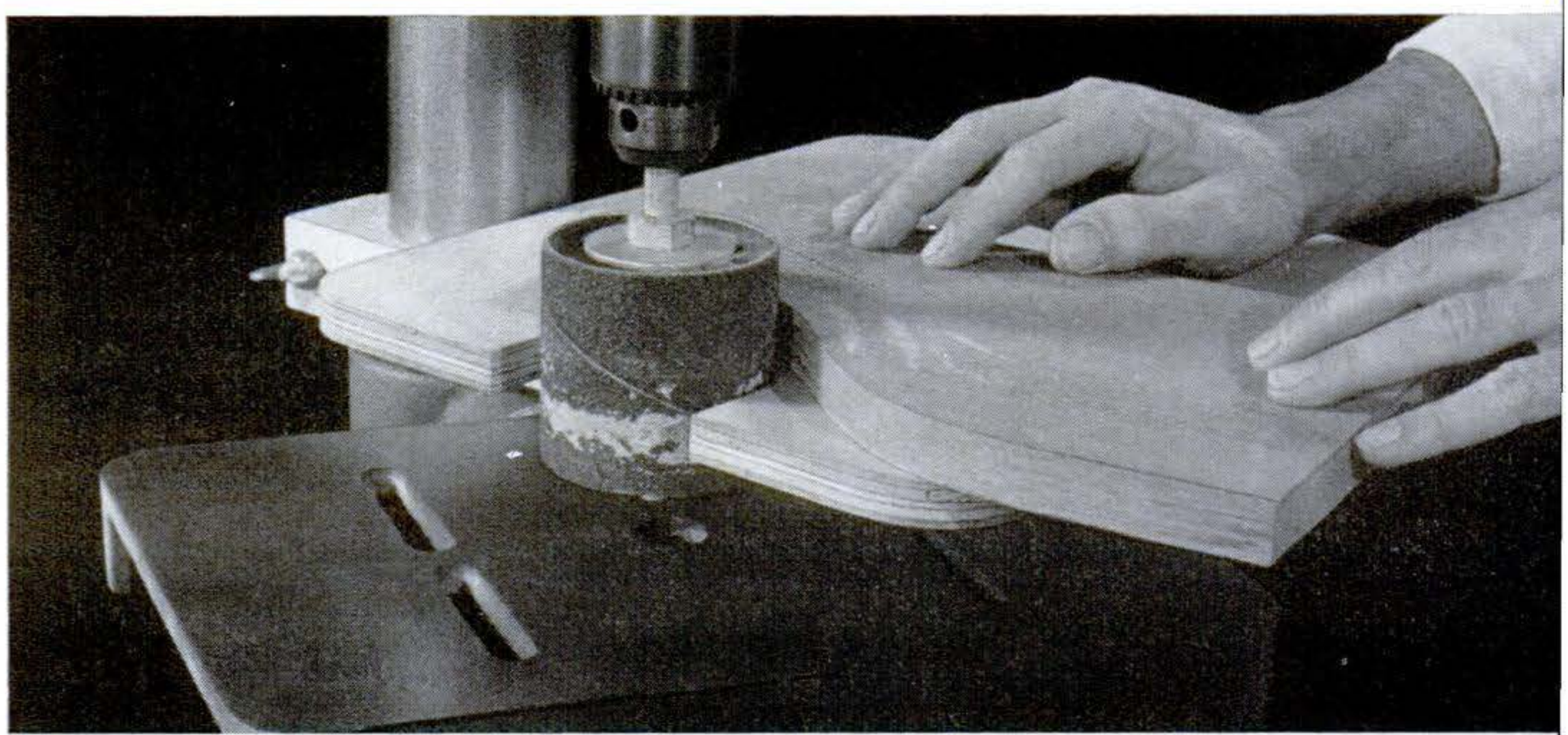
The clamps must lock tight on the drill-press column. If you have a hole saw or a fly cutter that will cut the correct size hole, it's a good idea to form the support arms from a single piece of stock. You can then cut on the hol centerline. The saw cut removes jus enough material to give you a good spli clamp action. Another method is t work with two pieces of wood, band-saw ing or jigsawing a half-circle in eacl and sanding off about 1/32" from eac edge.

If you find it necessary to chang dimensions, don't use a thinner materia on the clamp parts. Reducing the bea ing surface will lessen the grip yo need to support case or table. P





This table might be most convenient for a smaller drill press. But it also provides an efficient setup for drum-sanding (although the design makes it necessary to stay on one side of drum as you work).



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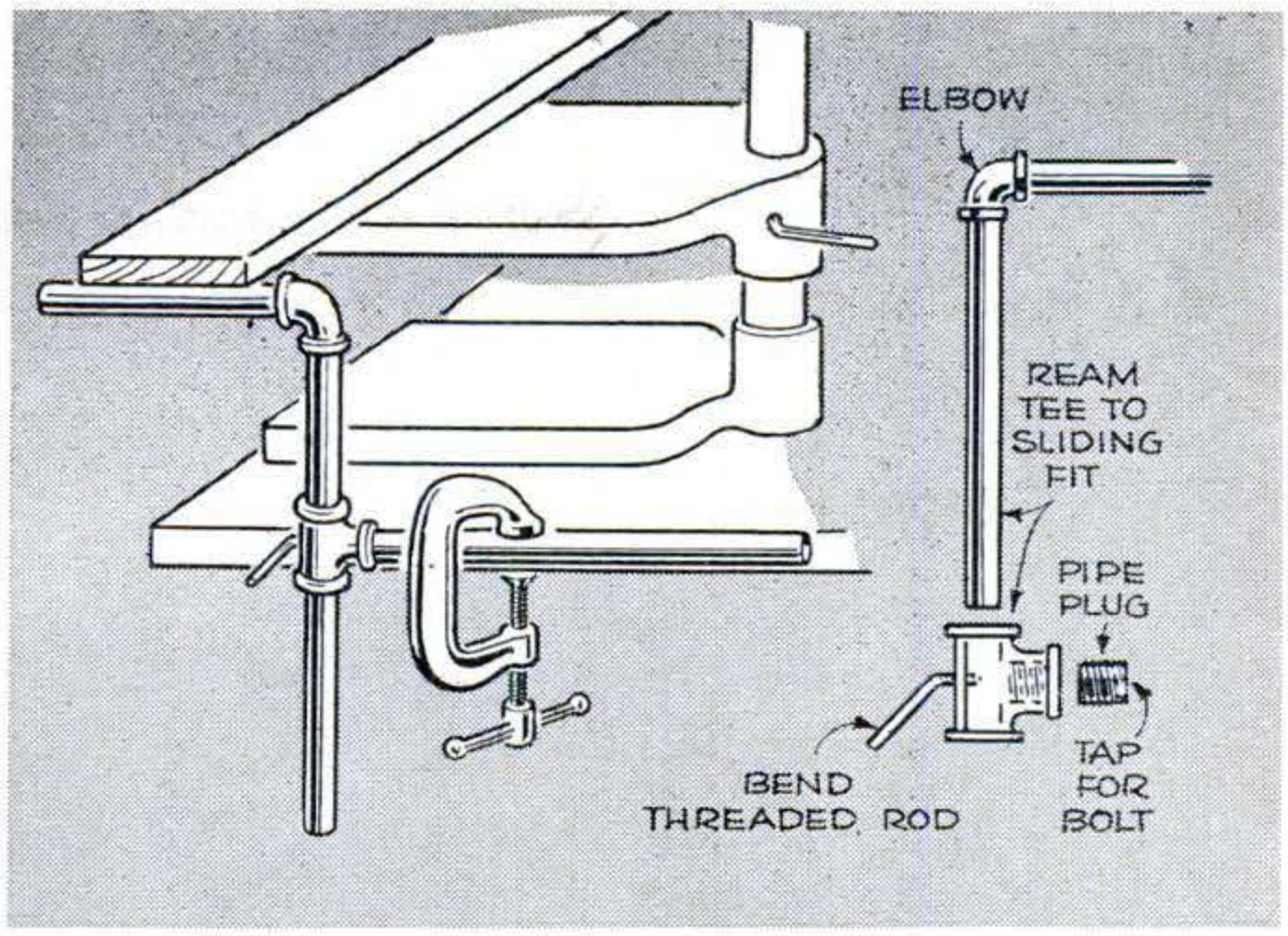
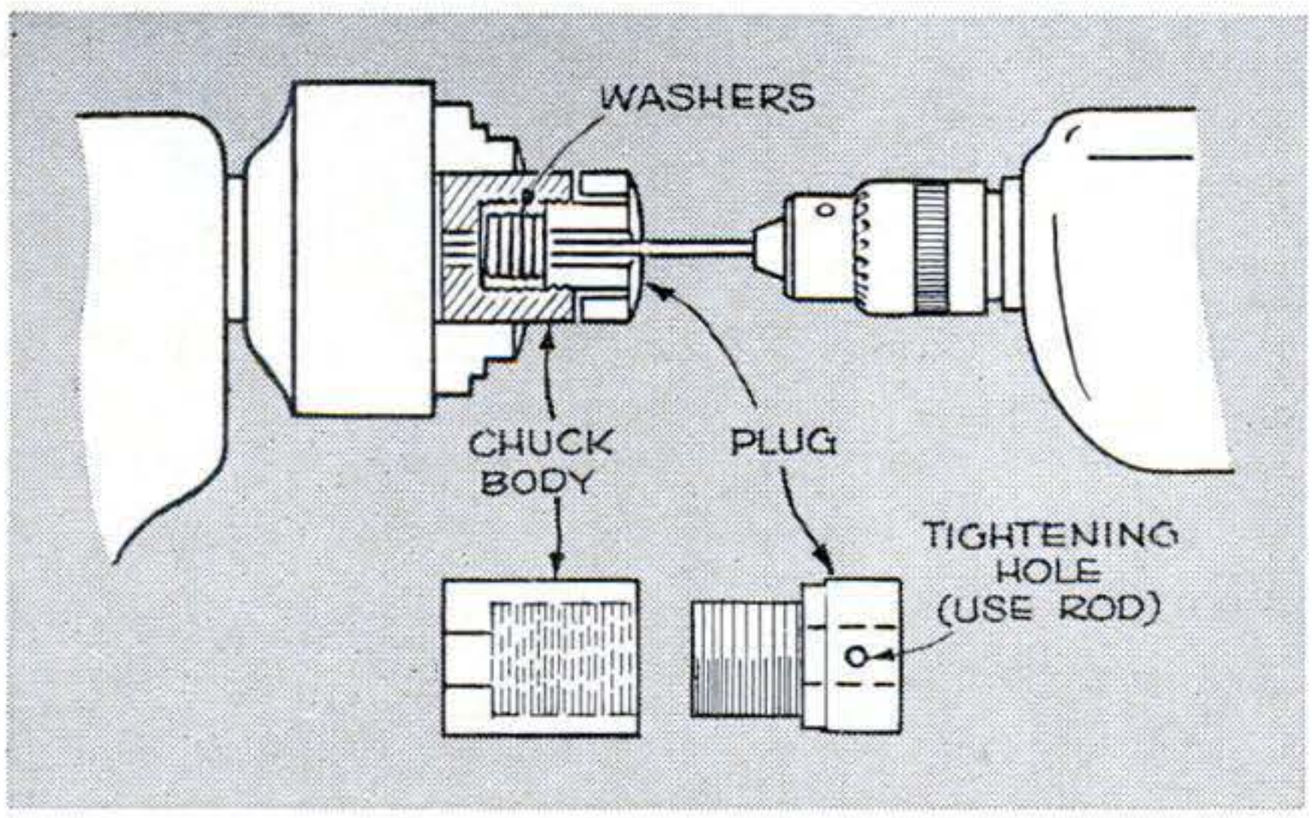
4 Good Ideas for Machinists



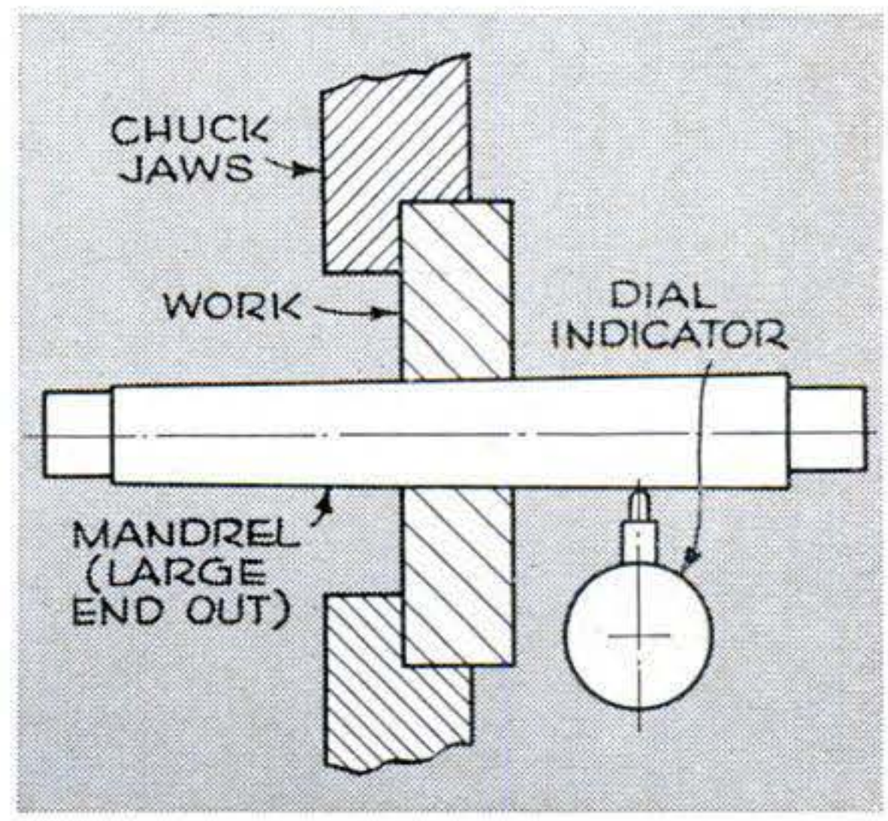
WINTER WORKSHOP IDEA 34

An adjustable work support that clamps almost anywhere is made of pipe parts. Ream out a tee to a sliding fit for the vertical leg of an L-shaped assembly. Tap the tee for a lockscrew —handiest is a threaded rod bent 45 degrees. Drill and tap a plug for a 1/4" or 5/16" bolt. Screw plug into side of tee and bolt through C-clamp frame.



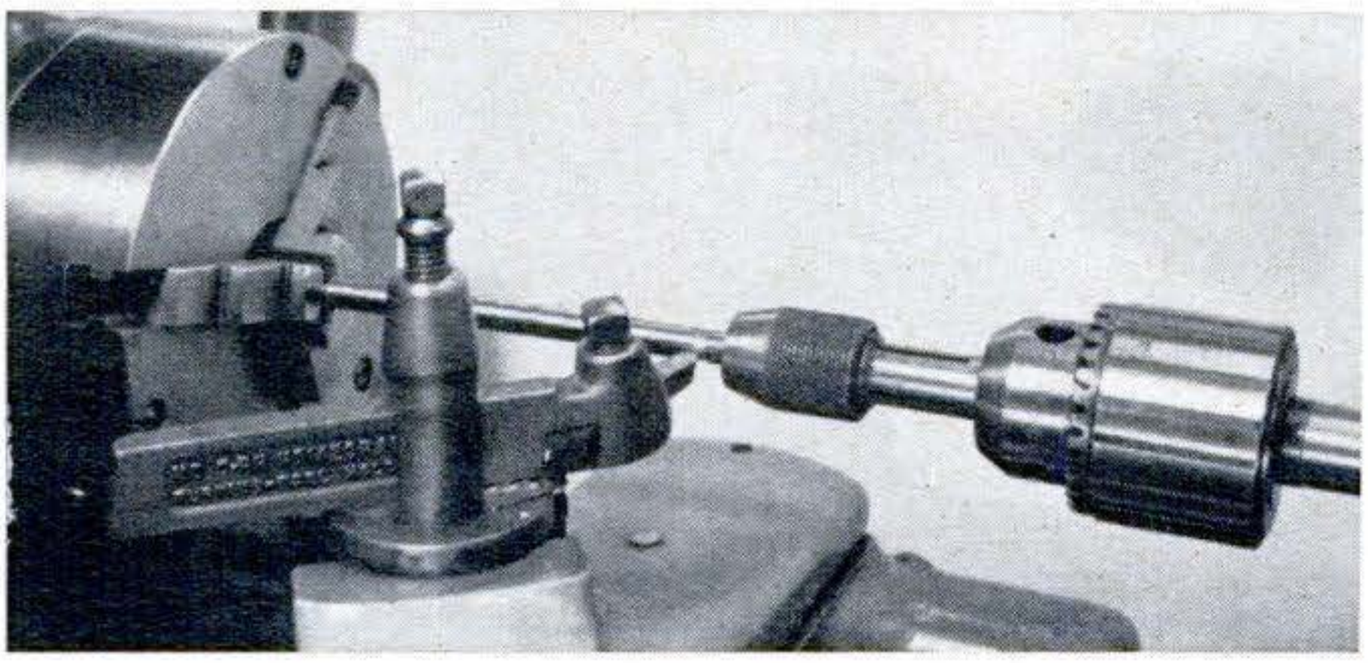
WINTER WORKSHOP IDEA 35

When you're enlarging holes in washers, this two-part chuck will hold several in the lathe at once. Make the hollow plug first. Chuck cold-rolled stock; bore and thread it to fit a threaded plug. Assemble the two parts in the lathe chuck and drill a hole through the unit. Drill a hole in the side of the plug for a tightening lever. To center washers in the chuck, place them and the plug on a close-fitting rod or drill held in the tailstock. Slip the washers into the chuck and tighten the plug against them.



WINTER WORKSHOP IDEA 36

Centering work bores in the lathe goes faster if you apply the dial indicator to an outside diameter. To do it, position a standard lathe mandrel snugly in the bore by hand. The indicator is used on the mandrel, the work adjusted, and mandrel removed. Subsequent work will be concentric to the bore.



WINTER WORKSHOP IDEA 37

To support thin stock for turning, make an adjustable hollow tailstock center from a T-handled tap wrench. Remove the handle and turn that part of the body to fit the tailstock chuck or the taper hole in the tailstock spindle. The wrench shown takes stock from 15/64" to 11/32"; other sizes will fit different work ranges. Oil the work, and tighten jaws, so work rotates freely.

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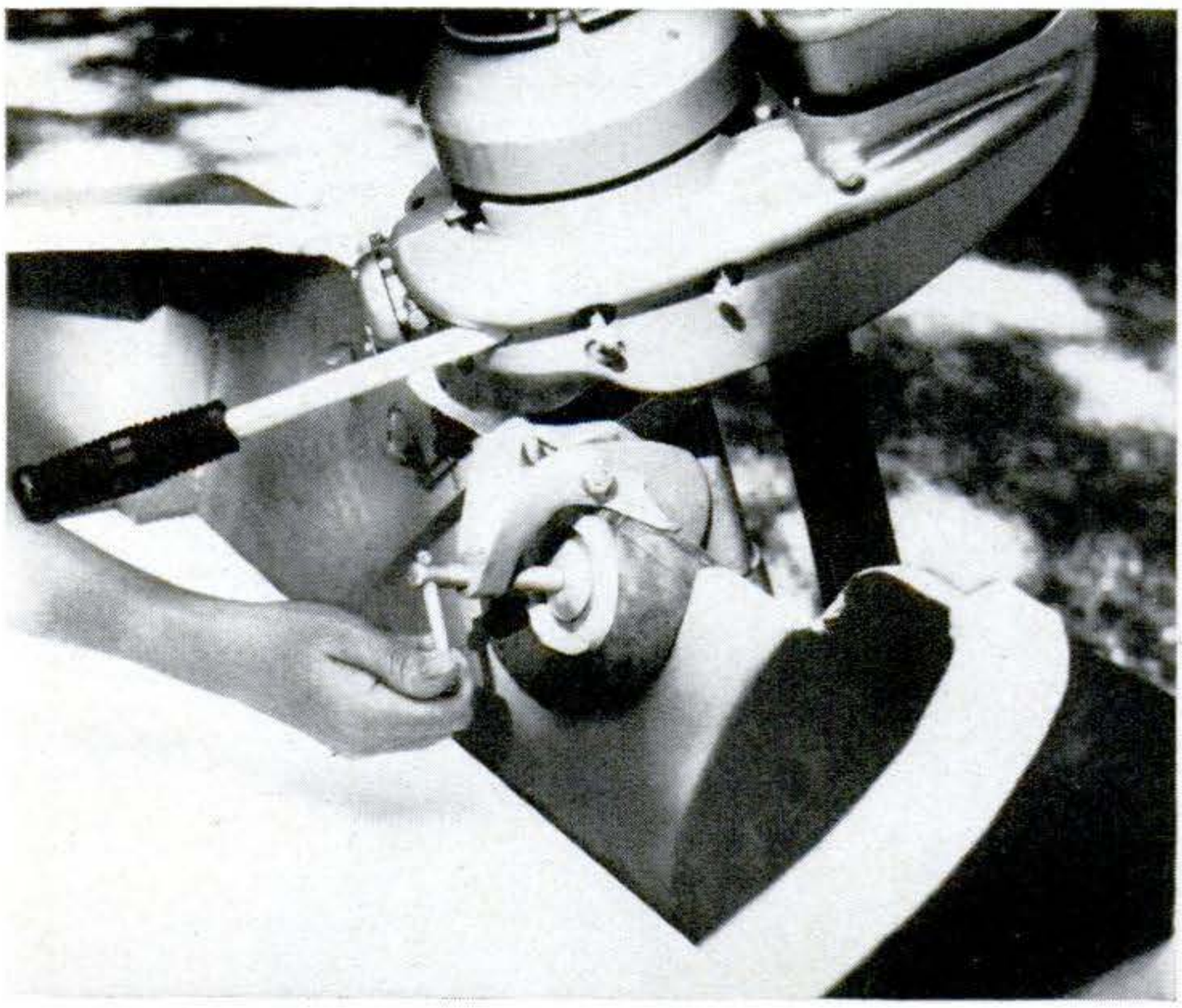
4 Good Ideas for Boatsmen

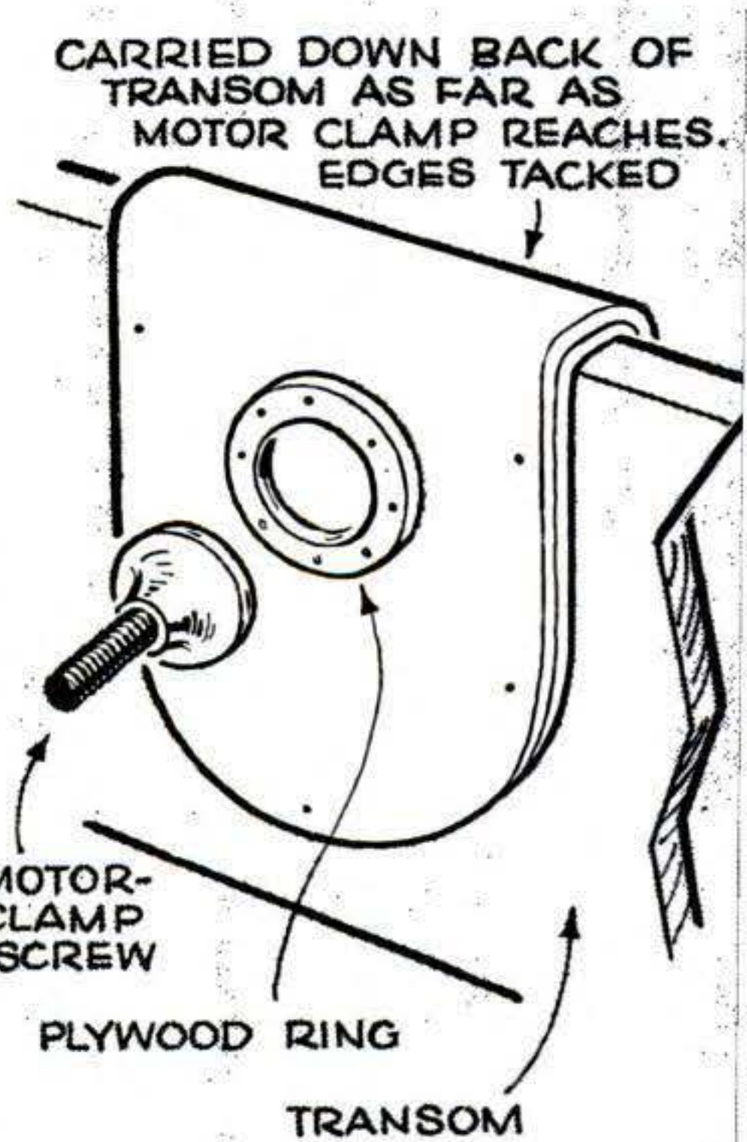
Three-wheel dolly makes canoe portage from beach house to water easy. One end rests on the dolly—you tote only half the weight.

Roll, roll, roll your boat

WINTER WORKSHOP IDEA 38

No more grunting and groaning to get your boat in and out of water if you build this dolly. All it takes is ¾″ exterior plywood, three casters, and some old garden hose. Cut a plywood T (drawing, far right), attach the casters, and fasten on the garden-hose "keel guides" with brass screws. Finish with two coats of marine paint and apply grease to the casters to prevent rusting.





Rubber absorber stops outboard vibration from rattling your nerves and boat's transom

WINTER WORKSHOP IDEA 39

Outboard-engine vibration can be disturbing to your boat's transom and your ears. Spare both by making this vibration absorber. Tack a double layer of inner tube over the transom top and down as far as the clamp reaches. A plywood ring keeps the motor from skidding out of position if the clamp vibrates loose on the rubber. Cut it out of ¼″ or ½″ exterior plywood, its inside diameter ½″ larger than the outside diameter of the clamp's screw foot. Position the engine on the rubber and trace the screw-foot outline. Copper-nail the ring in place. Cut the rubber so that it extends 3″ on all sides of the plywood ring for extra noise damping.

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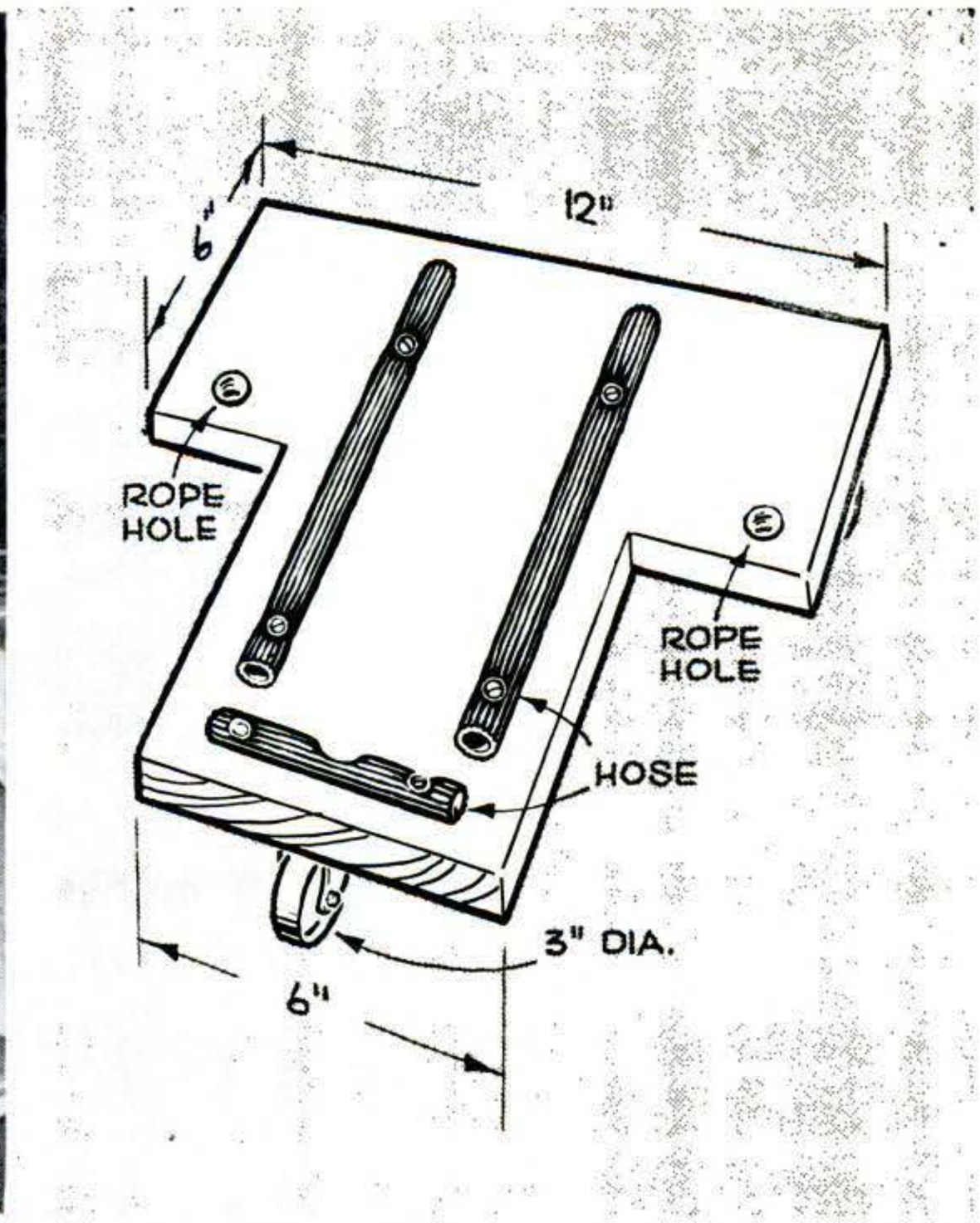
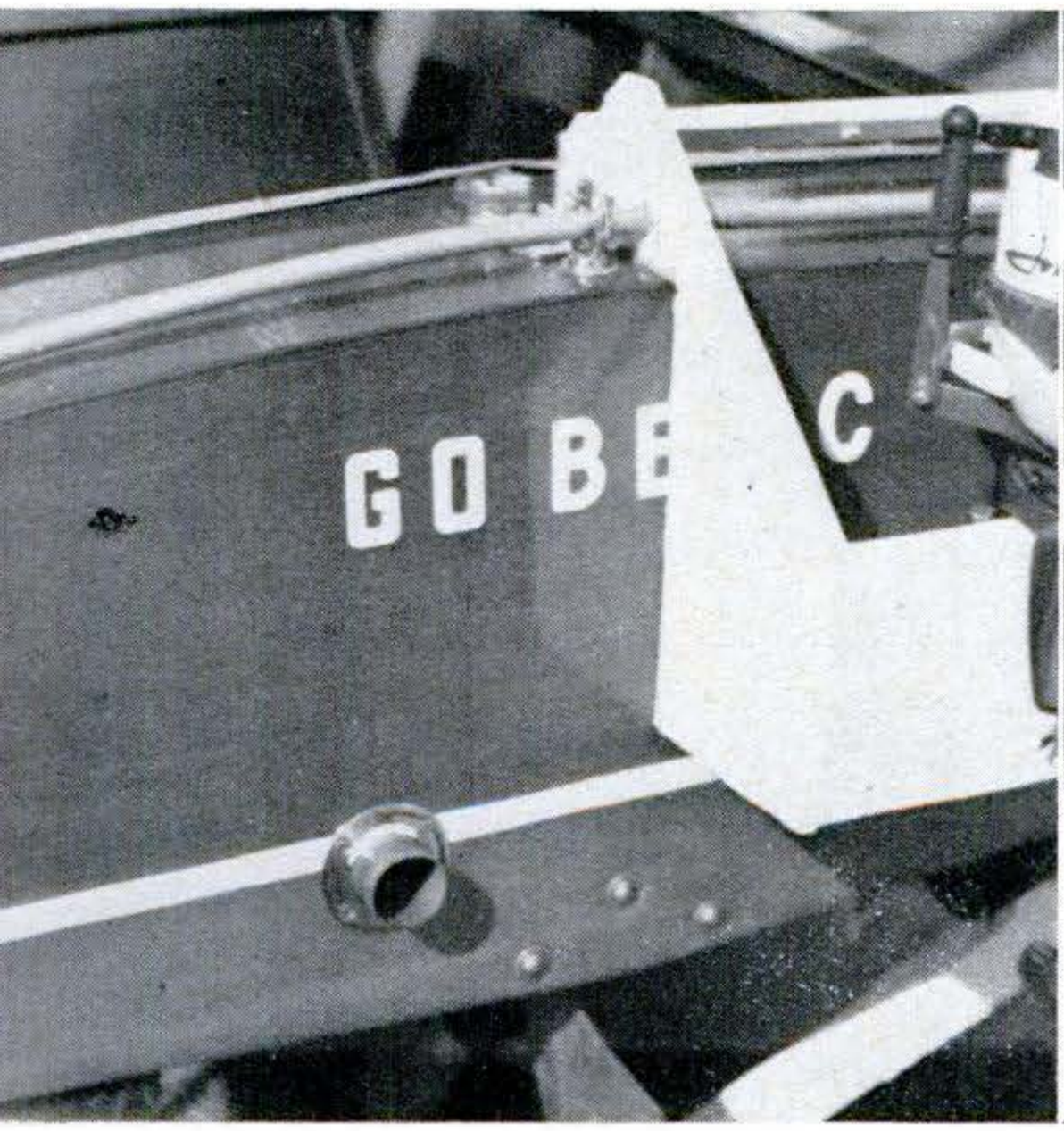
With the dolly at the balance point of a boat, you can roll it along without carrying any weight.



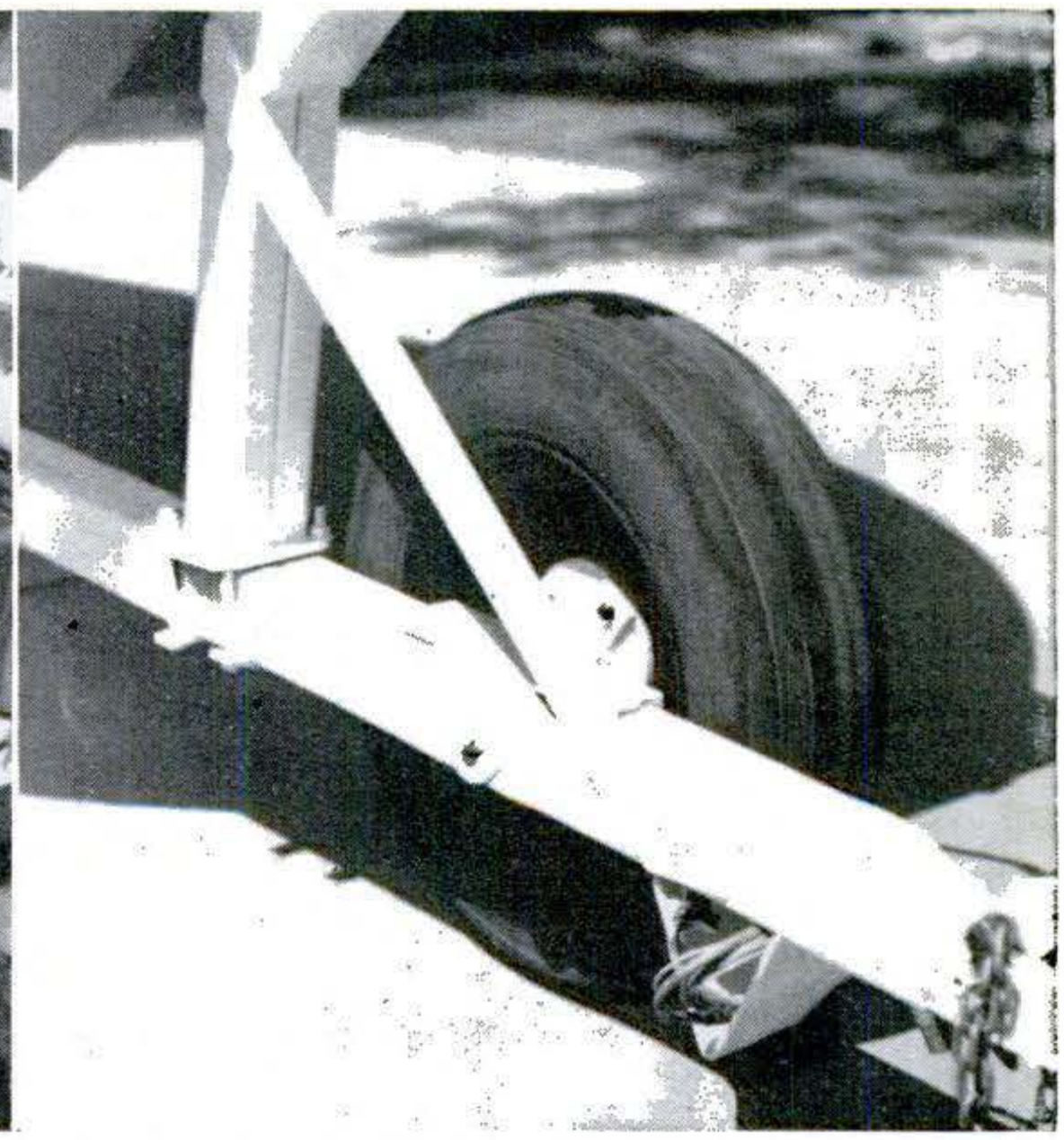
Build to custom-fit your own boat. Marine paint on wood, grease on casters, permit in-water launching.



Trolling-engine mount doesn't mar hull

WINTER WORKSHOP IDEA 40

Of ½" marine plywood, with felt glued to mounting surfaces, this bracket won't chafe a hull. It's held by electrical conduit passed through port and starboard tow hooks and center lifting ring, and won't budge. To remove it, withdraw the tubing. Use double plywood where clamp screws fasten.



Spare tire makes boat launching easier

WINTER WORKSHOP IDEA 41

Add an axle spindle to your trailer and use your spare tire as a non-swiveling dolly for straight-line launching. Weld it to the tongue, or to a bracket which you bolt to the tongue (above). Set the wheel for maximum road and tow-car clearance. Trailer-repair and automotive shops carry spindle parts.

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HOW TO BUILD A
Shaker Candlestand...

By DAVID WARREN

Shaker-style furniture is unique. Its simplicity of design and clean lines blend with practically any furniture style. The design and construction of these two pieces is typical of those produced 150 years ago—except that you'll build yours a lot faster than the original craftsmen did.

The table is made of cherry, which is not usually available in 1/2″ or 5/8″ thickness; so it's necessary to plane down 3/4″ stock. Or you can have it done at the lumberyard mill; the cost is nominal. Since the candlestick will be painted—make it out of less expensive pine.

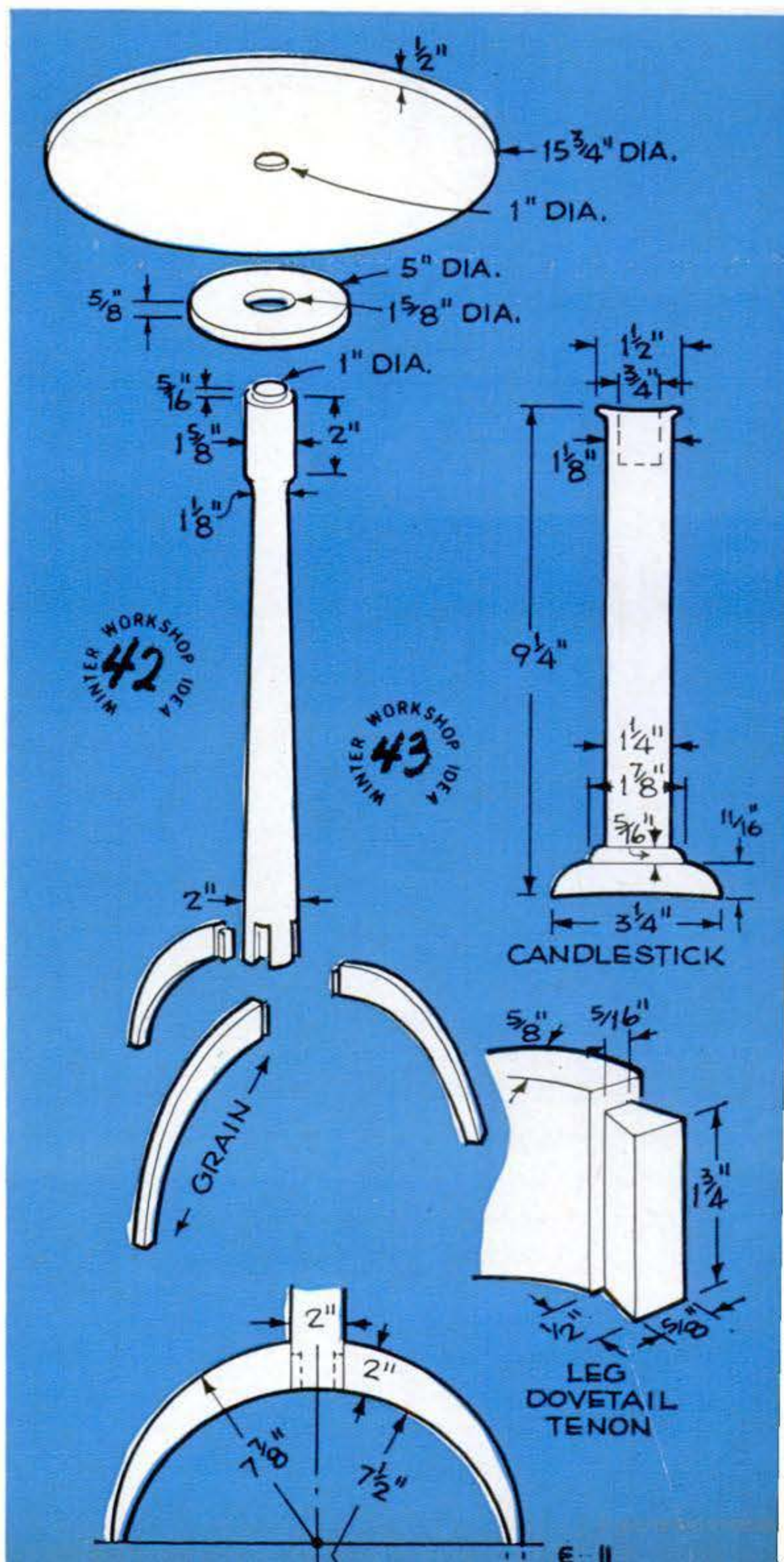
Making the table. Begin construction with the top. Match the grains and mark the best arrangement. Tongue-and-groove the boards and glue them together. When the top is dry, plane 1/8″ off each surface. Next, draw the circle on the underside and mark the center. Cut the top, and round the edge with a router and 1/4″ quarter-round bit. Use a Forstner bit to bore the 1″ hole for the post.

Turn the post on a lathe to the dimensions shown; maintain a close tolerance in the diameter of the 5/16″ stub that fits into the top. Size the calipers to the Forstner bit for accuracy.

Next lay out the 5″ disk on a piece of 5/8″ stock. The 1 5/8″ hole is bored with an expansion bit; practice on scrap first and test-fit to the post. When the bit is set correctly, bore the hole and cut out the disk.

Cut the legs (also 5/8″ stock) and round the edges. The most important contruction detail here is the dovetail where the legs slide into the post. If the fit is loose, the joint will be weak; too tight, and you can split the post. Mark and cut the tenons on the legs. Use a coping saw on each shoulder where the leg joins the post. On the base of the post carefully lay out the three dovetail mortises an equal distance apart. Use the tenons as templates. Cut the mortises with a 1/4″ chisel and mallet so each leg fits snugly.

Putting it together. Assemble the table with glue and place it on a level surface. Check the top with a level and the post with a framing square. When you are satisfied that top and post are true, center a 10-pound weight on the top until the glue dries—at least 24 hours.



nd Candlestick, Too

After a final sanding, finish the table with your preferred method. The table shown was finished with shellac.

The candlestick. This one is made of wood, styled after the metal candlesticks used by the Shakers. It's easily turned from four-by-four stock.

If your lathe is equipped to drill, turn the candlestick with the top toward the headstock so you'll be set up for boring the candle hole later.

Turn the piece as shown and cut the bottom slightly hollow with the parting tool, to about 1". Then cut off the upper end. Bore the ¾" hole for the candle with the base of the candlesticks held firmly against the tailstock center.

Glue felt to the bottom and paint the candlestick to simulate metal. Apply a coat of aluminum paint and let dry. Then brush on flat black enamel, and when it is tacky wipe lightly with lint-free cloth.

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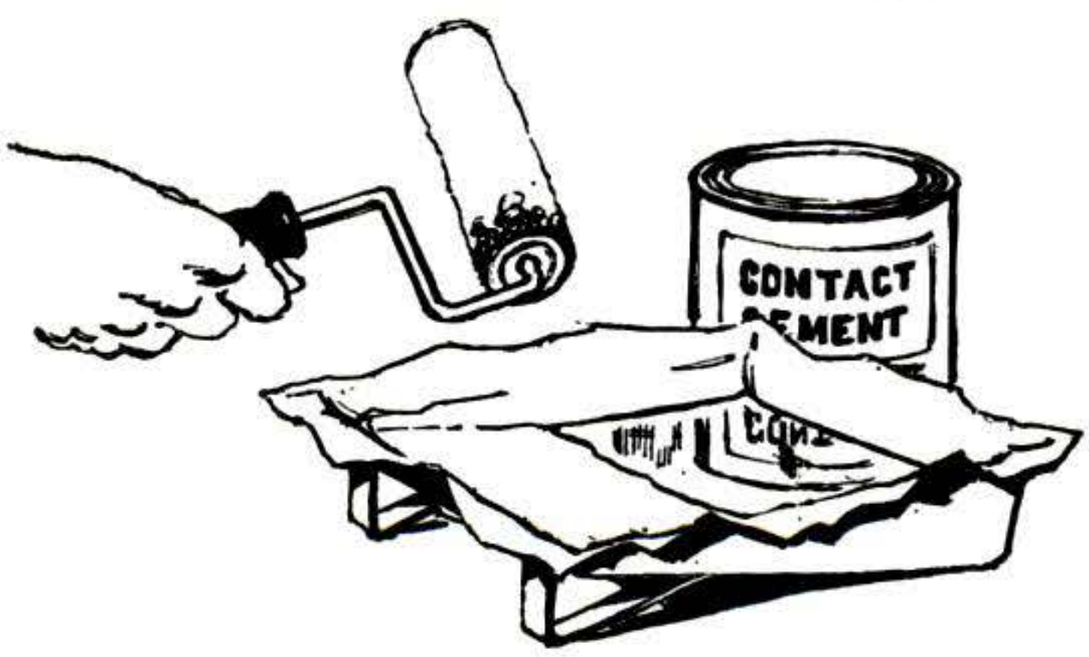
9 Good Gluing Tricks

By HARRY WICKS

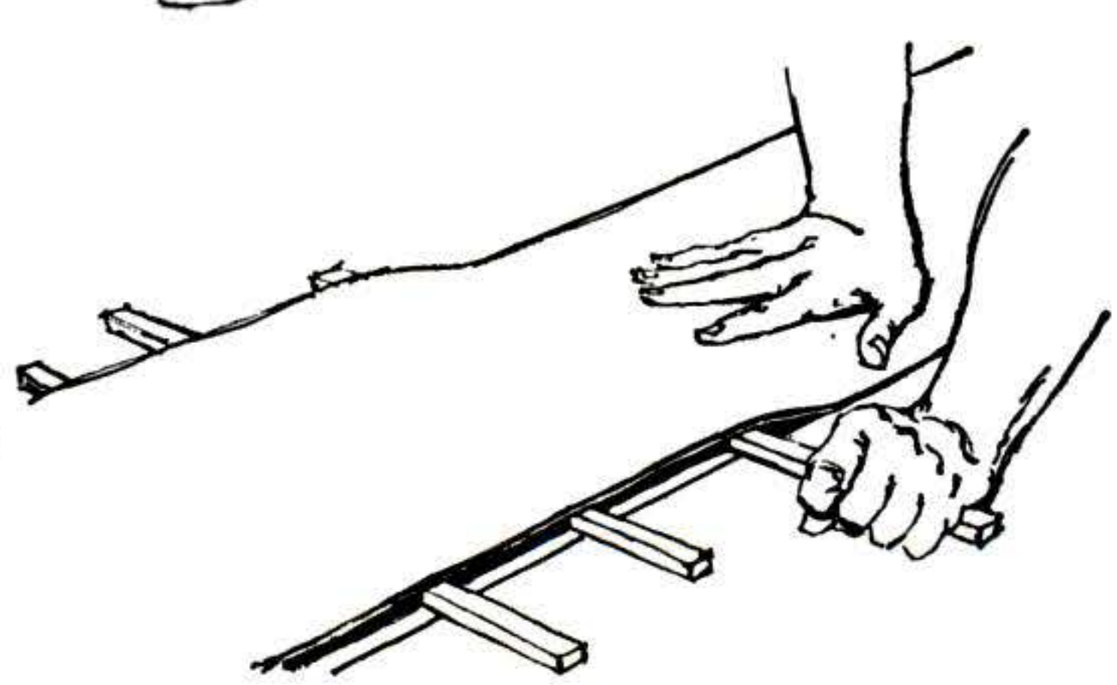
WINTER WORKSHOP IDEA 44

White glue is practically invisible when it dries; and then it's hard to find any excess that should be removed before you stain. If your project requires an uninterrupted gluing sequence, the glue will set by the time you check. Solution: Stain before gluing. When the stain dries, you can assemble the unit without worrying about overlooked glue; the stain shows through.



WINTER WORKSHOP IDEA 48

Loose spots (bubbles) on plastic laminates are usually caused by poorly spread contact cement. You can get a better bond by using a frieze roller and tray. The speedier application equalizes drying time, and the glue will be spread more evenly. To clean up fast, line the tray with aluminum foil. When finished, roll the foil up and discard it in a covered can.



WINTER WORKSHOP IDEA 49

Not enough brown paper to prevent accidental adhesion of two spread surfaces? Rip eight or 10 1" strips from clean ¾" stock. Cut them a foot or so longer than the width of the workpiece, and space them every 12" apart on the board to keep the surfaces apart. As you work your way down the length, remove the sticks one at a time and press the laminate in place.

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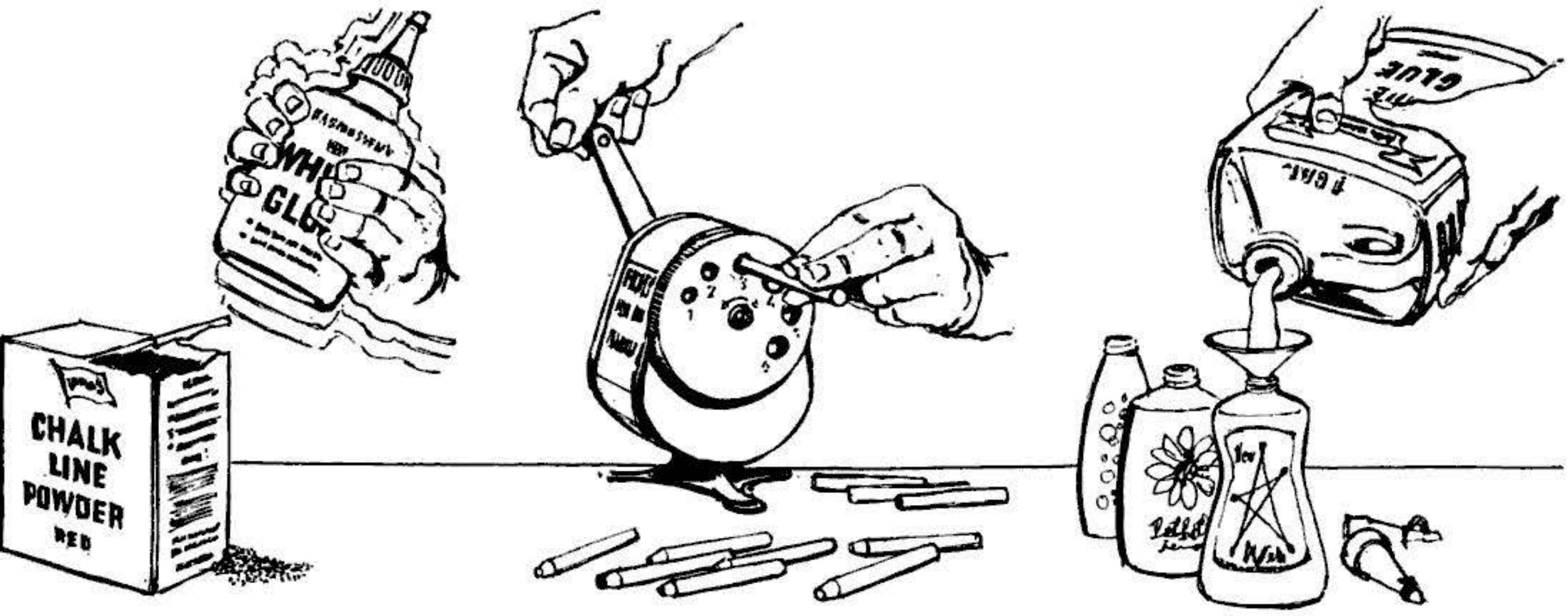


WINTER WORKSHOP IDEA 45

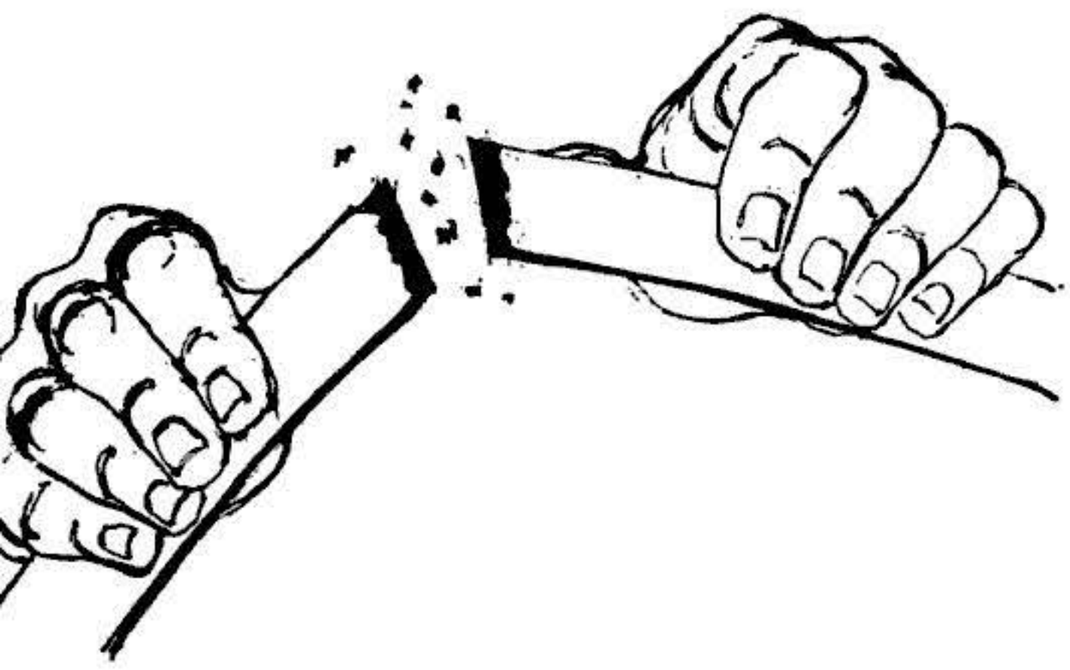
Tinting glue, as the pros do, eliminates the problem of hard-to-spot glue. You can get the same re- by adding a small amount of k-line powder (blue or red) to glue bottle and shaking it. Then glue in the wrong spot can seen and removed in a hurry.

WINTER WORKSHOP IDEA 46

When gluing with dowels, sharpening them by hand takes time. Use your pencil sharpener the next time you have a batch to do; the cutters make a perfect chamfer. A model with adjustable hole sizes will handle the dowels most often used in cabinetwork.

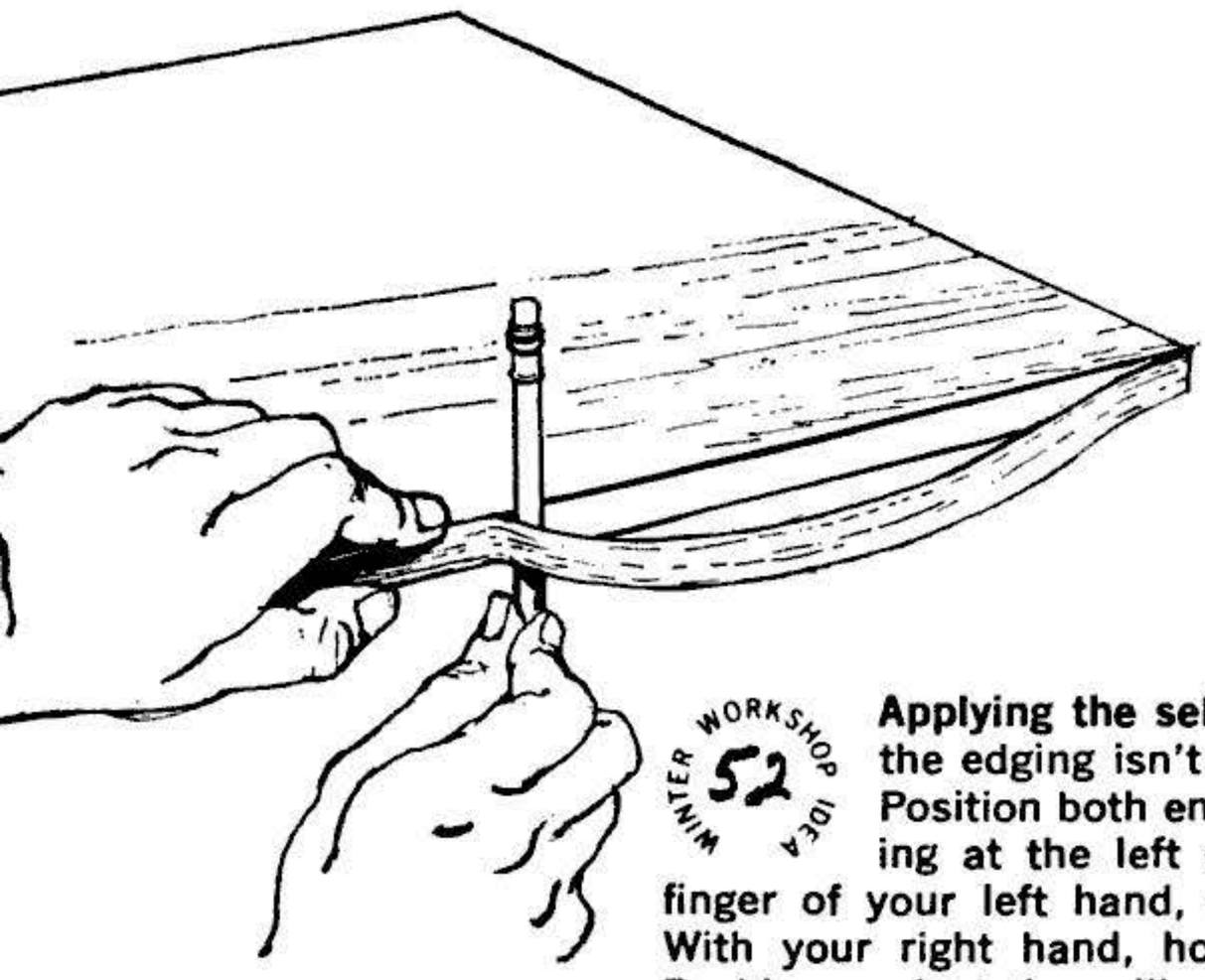
WINTER WORKSHOP IDEA 47

Buying glue in small quantities is costly if you do a lot of gluing. Buy it by the gallon. Save your liquid-detergent plastic bottles, and keep one or two filled from the gallon jug. Enlarge the hole with a four-penny nail, and use the nail as an easy-lift stopper.



WINTER WORKSHOP IDEA 50

Scraps of plastic laminate are handy around the shop—don't throw them out. Only 1/16" thick, a strip makes a perfect tool for getting excess glue out of corners. When you break the pieces, the laminate usually oops off at the break; that brings it to 1/32" thick.



WINTER WORKSHOP IDEA 51

If your shop is unheated and some winter morning nothing happens when you squeeze the glue bottle, chances are the glue is frozen. Some glues can, and some can't, be used after being thawed out. Check the label before throwing the glue out. Best bet is to store glue in a heated area.

WINTER WORKSHOP IDEA 52

Applying the self-edge to a counter top is tricky. To make sure the edging isn't off course when you get to the far end, try this: Position both ends lightly, allowing the middle to bow out. Starting at the left end, grasp the strip between thumb and index finger of your left hand, with fingertips touching the board as a guide. With your right hand, hold a pencil between the self-edge and board. Pushing against the rolling pencil, guide the strip with the left hand.

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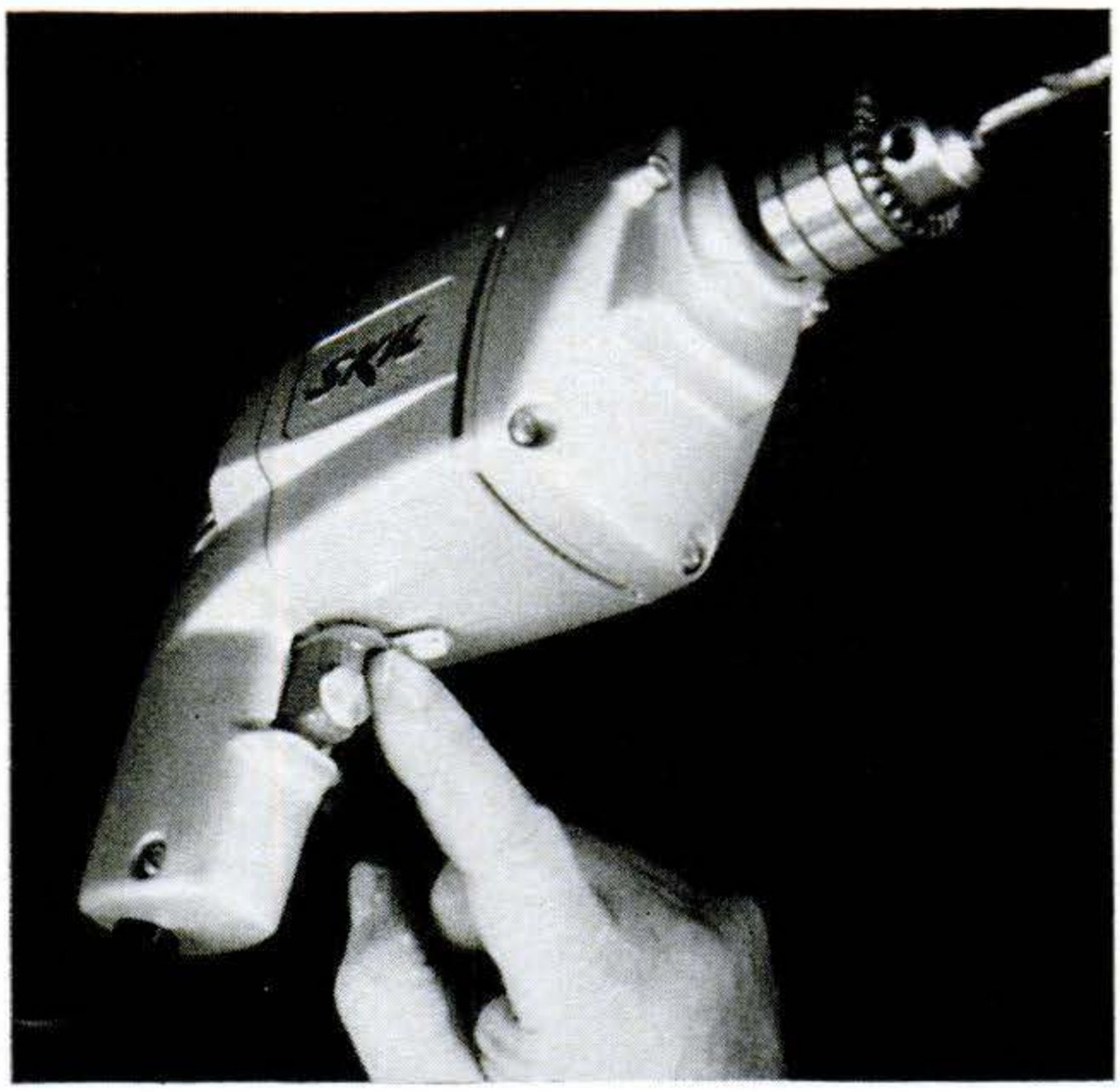


4 Good-Idea Tools

Button sets maximum drill speed

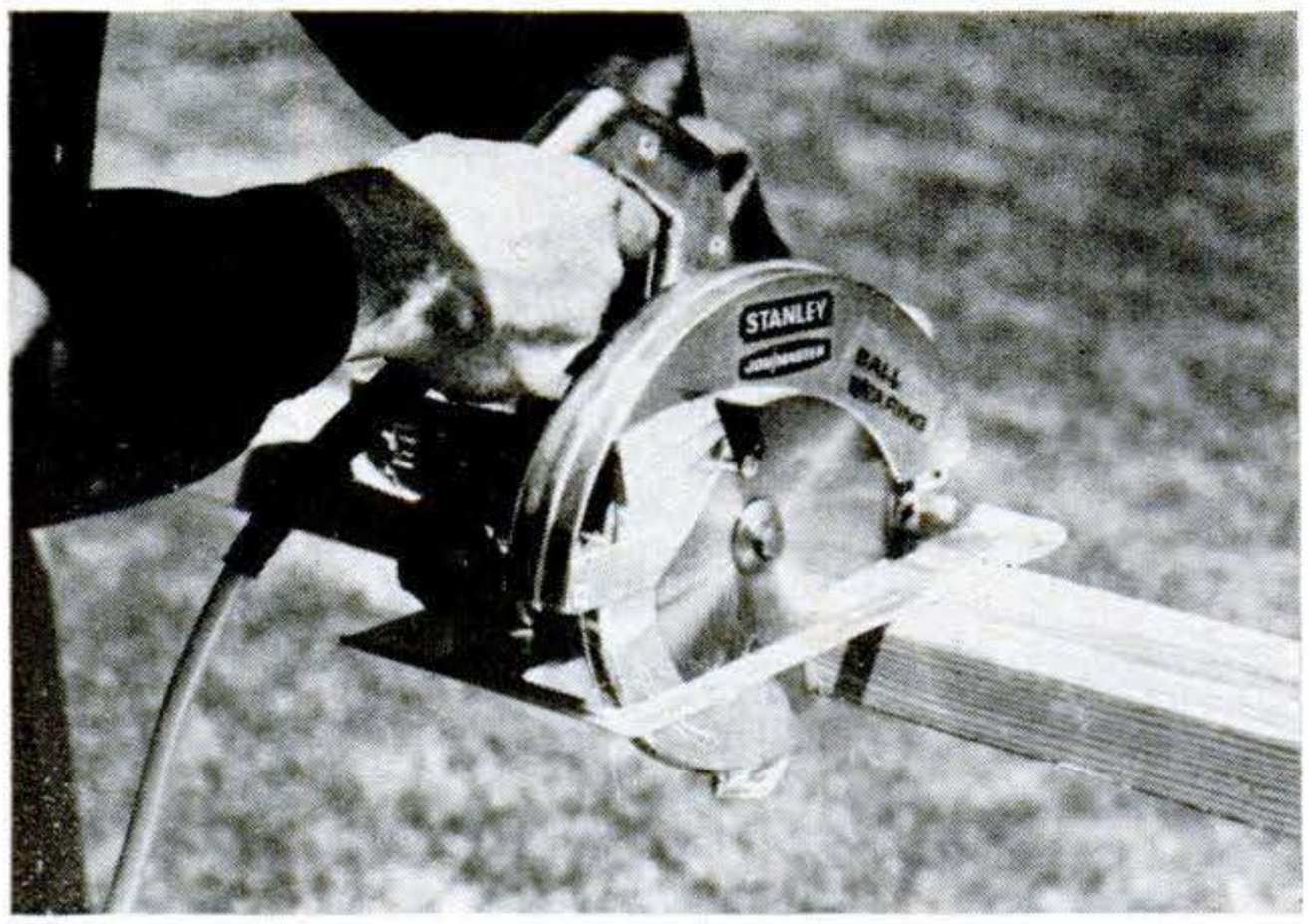
WINTER WORKSHOP IDEA 53

Skil Drive-R-Drills now have another first—a turn-in button that limits the amount you can depress the variable-speed trigger. Thus, you can preset the maximum speed before you begin the job. Drive-R-Drills come in ¼", ⅜", ½" sizes.

Wrench removes frozen nuts

WINTER WORKSHOP IDEA 54

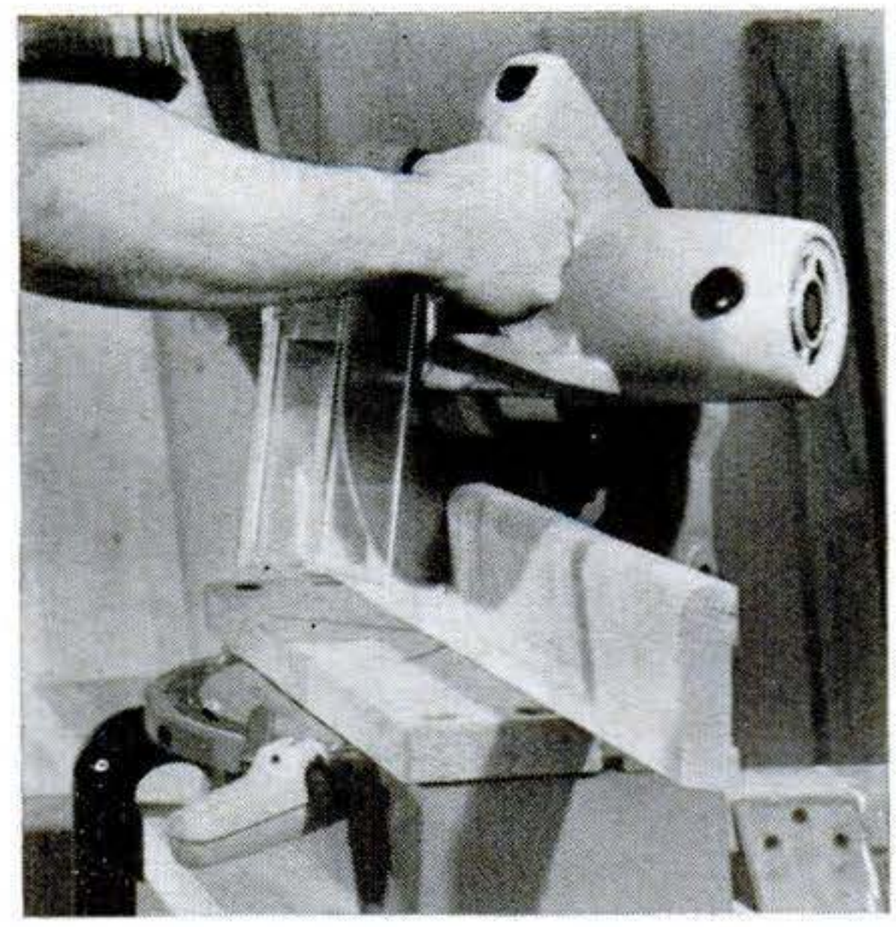
When you encounter a frozen nut, set this tool's chisel point on a flat, turn up the forcing screw at the opposite end of the tool, and the chisel exerts 25,000 pounds' pressure on the nut. The nut breaks away without damage to bolt or stud. About $10 from Roycraft Industries, 1020 E. 79th Ter., Kansas City, Mo.



Saw has dust chute and adjustable auxiliary handle

WINTER WORKSHOP IDEA 55

A built-in dust chute keeps the cutting area clear when you use Stanley's new heavy-duty Job Master 7¼" circular saw. Powered by a two-hp. motor and fitted with ball and roller bearings throughout, the saw has an adjustable up-front auxiliary handle to help you keep on the line. About $80, with heavy-gauge rip guide included.



Motorized miter box

WINTER WORKSHOP IDEA 56

Motorized miter box introduced by Rockwell has a 9" saw. Among other jobs, it will accurately miter a ⅝"-by-3⅝" baseboard on edge. Blade brake in handle stops blade in seconds. It costs about $170.

Copyrighted material

Canoe Built from Siding

Two cedar clapboards and a panel of plywood are the major materials for this floating beauty

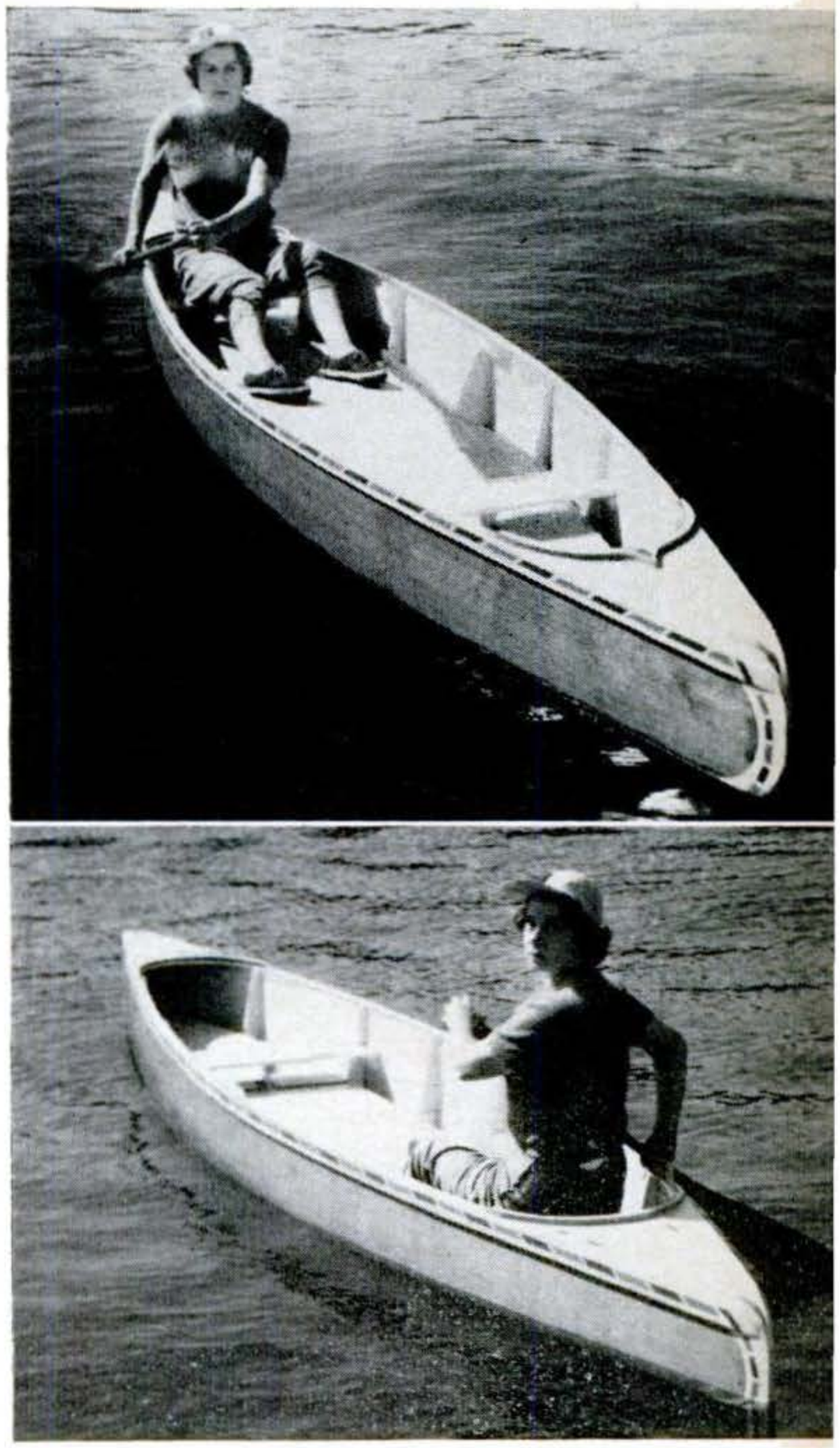
By GEORGE DANIELS

WINTER WORKSHOP IDEA 57

You don't have to be a boatbuilder to make this 65-pound, 16-foot canoe in a weekend. The cedar-clapboard sides produce and hold the hull shape when they are bent around the midframe and joined at the ends. Fit in the wedge-shaped stems at bow and stern, fasten on the bottom panels of 1/4" exterior plywood, and you actually have a floatable boat after about two hours' work.

You add three more frames (like ribs) in each half of the hull to stiffen it. But you don't have to follow fussy preset dimensions. Just cut them to fit right on the job, with the

Continued



With a paddler in the stern seat, the bow of this trim canoe just skims the water. Each side is a clapboard 10" wide. Indian-style decorations were made by applying strips of colored electrical tape.

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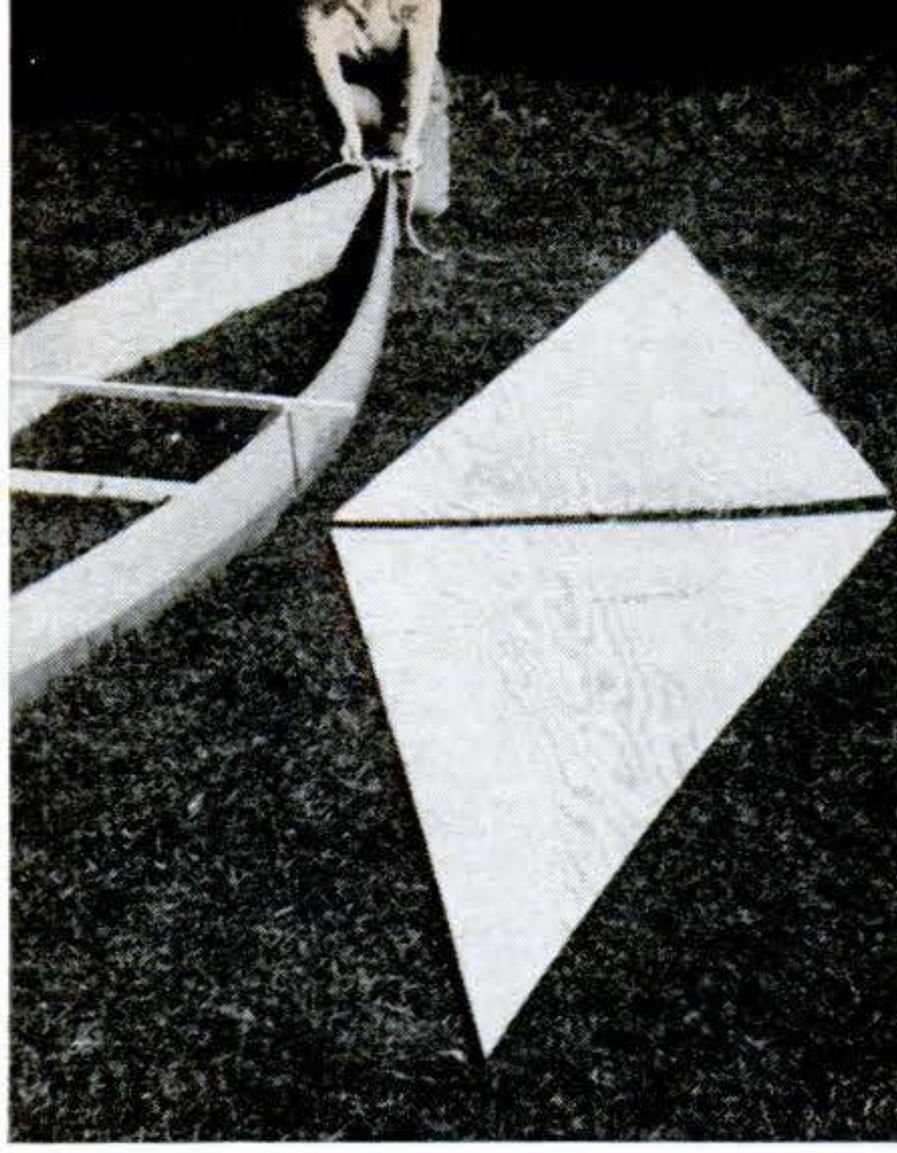
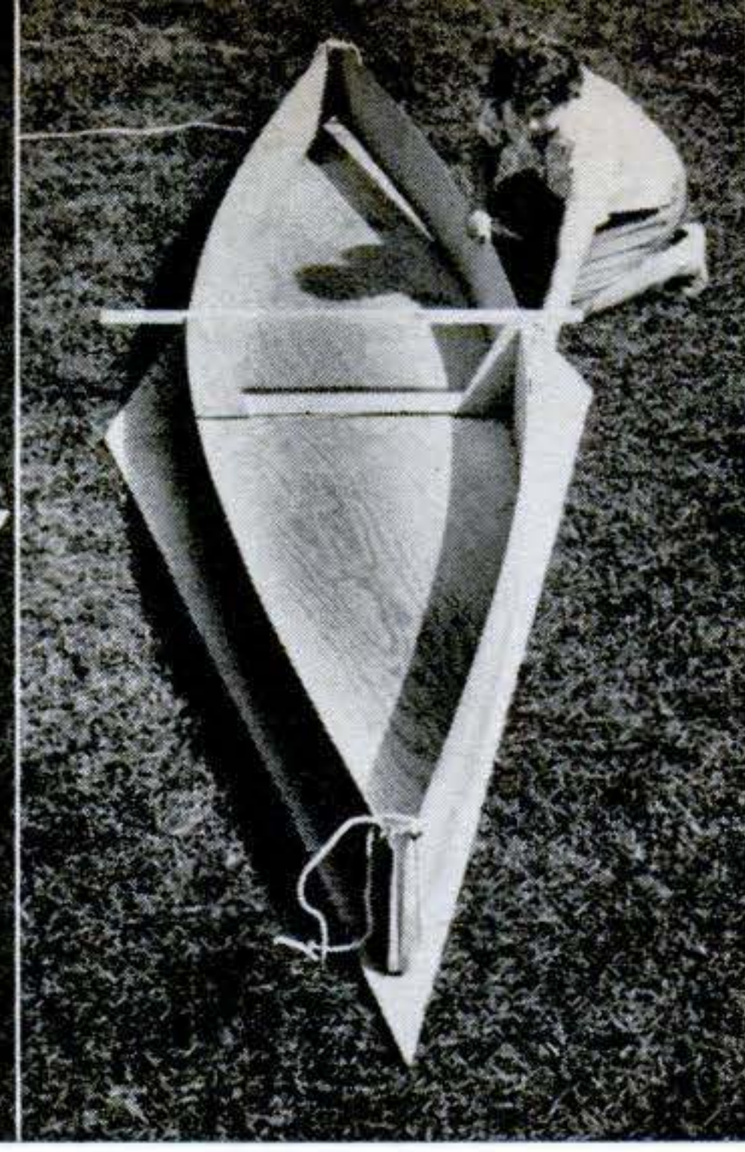
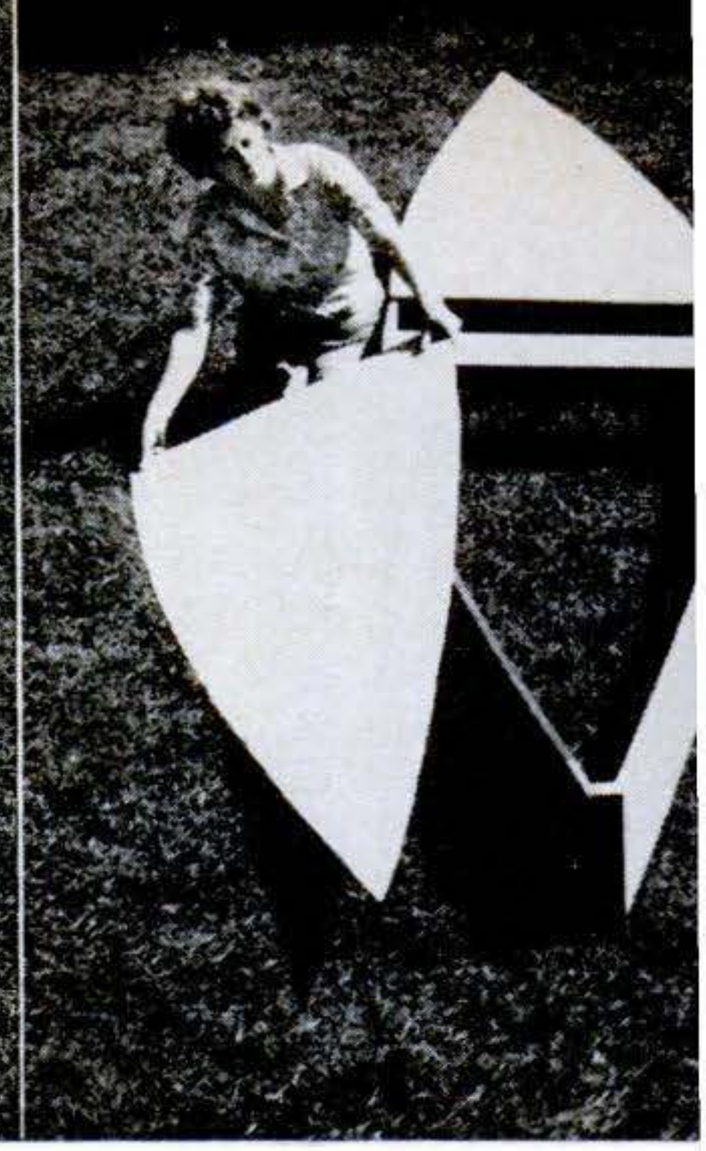


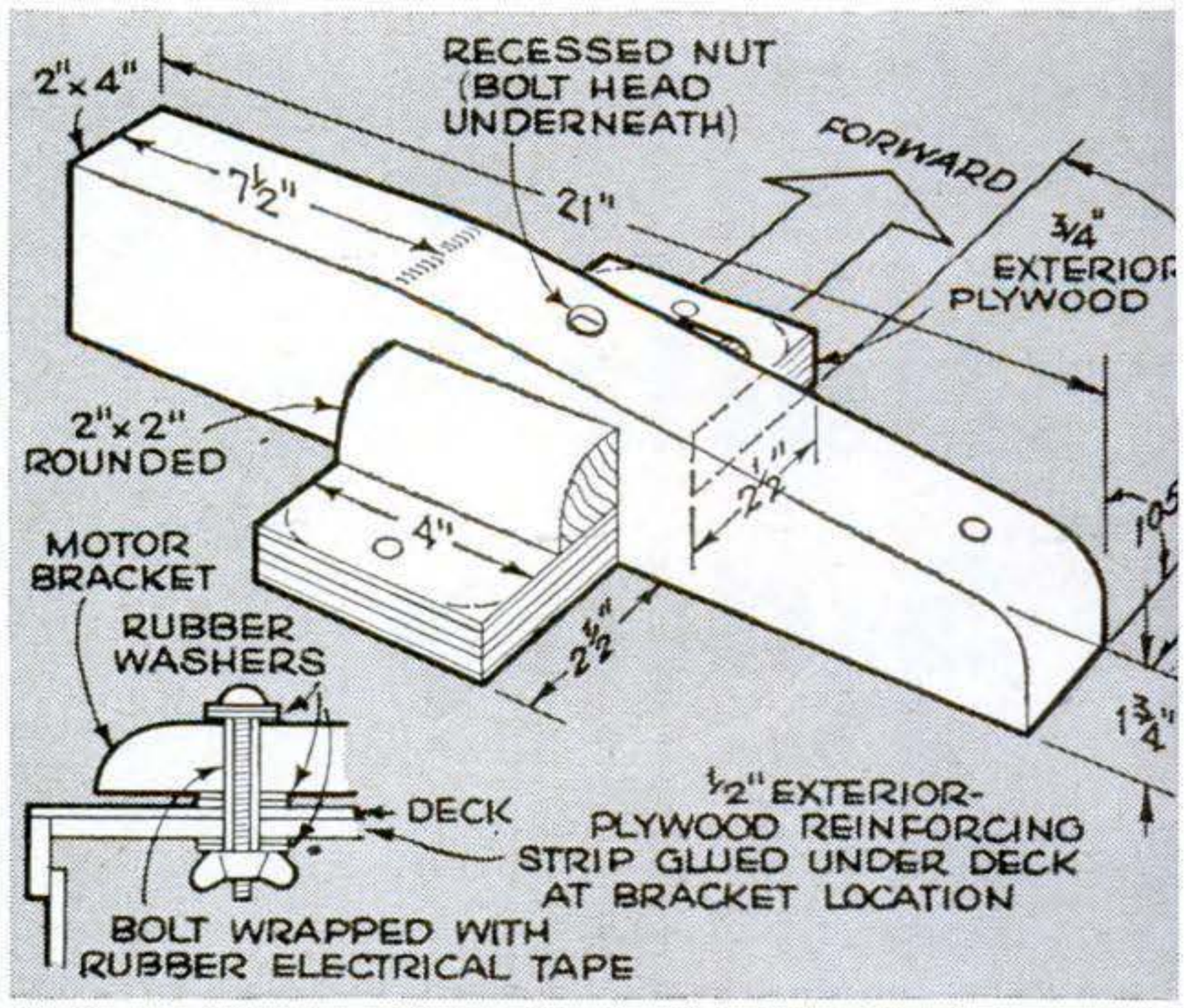
Basic canoe shape is made by bending clapboards around center frame and temporarily tying ends together. Plywood triangles at right are from diagonally cut 4′-by-8′ panel and will be canoe bottom.





Mark the bottom boards for cutting by placing clapboard assembly on top of triangles. Stem pieces are glued and screwed in place; seam butt piece is then glue-nailed over the midframe.

Decorate your canoe, after gunwales, cap strips, and decks have been added, and the hull varnished and pointed, by sticking strips of Johns-Manville colored electrical tape to the gunwales.



If you want to power the canoe, build the removable rubber-cushioned outboard-motor mount shown in this drawing and photo. The main part of the mount is a 21″ piece of two-by-four, shaped to the dimen-

indicated distances between them—and if the spacing varies by an inch or two it doesn't matter. There are no chines (corner strips along side-to-bottom seam); the wide edge of each clapboard side takes the place of a chine.

Weldwood resorcinol resin glue used on all seams and joints is also a gap-filler. You get a permanently watertight job without a precision fit.

The first step. Buy two 10″ cedar clapboards 16′ long. (They're actually about 9½″ wide.) If your local lumber-yard sells clapboards only in varied-length bundles, phone-check others. If the clapboard length is a little under the full 16′, okay. If it's a little over, so much the better. Cut them to match exactly; be sure the ends are square.

Make the midframe first. Coat all mating surfaces with glue, and use two 1¼″ copper nails to hold each joint while the glue hardens overnight. If you want to assemble the hull before the glue hardens, nail a scrap strip across the top of the frames (as shown in the early-step pho-

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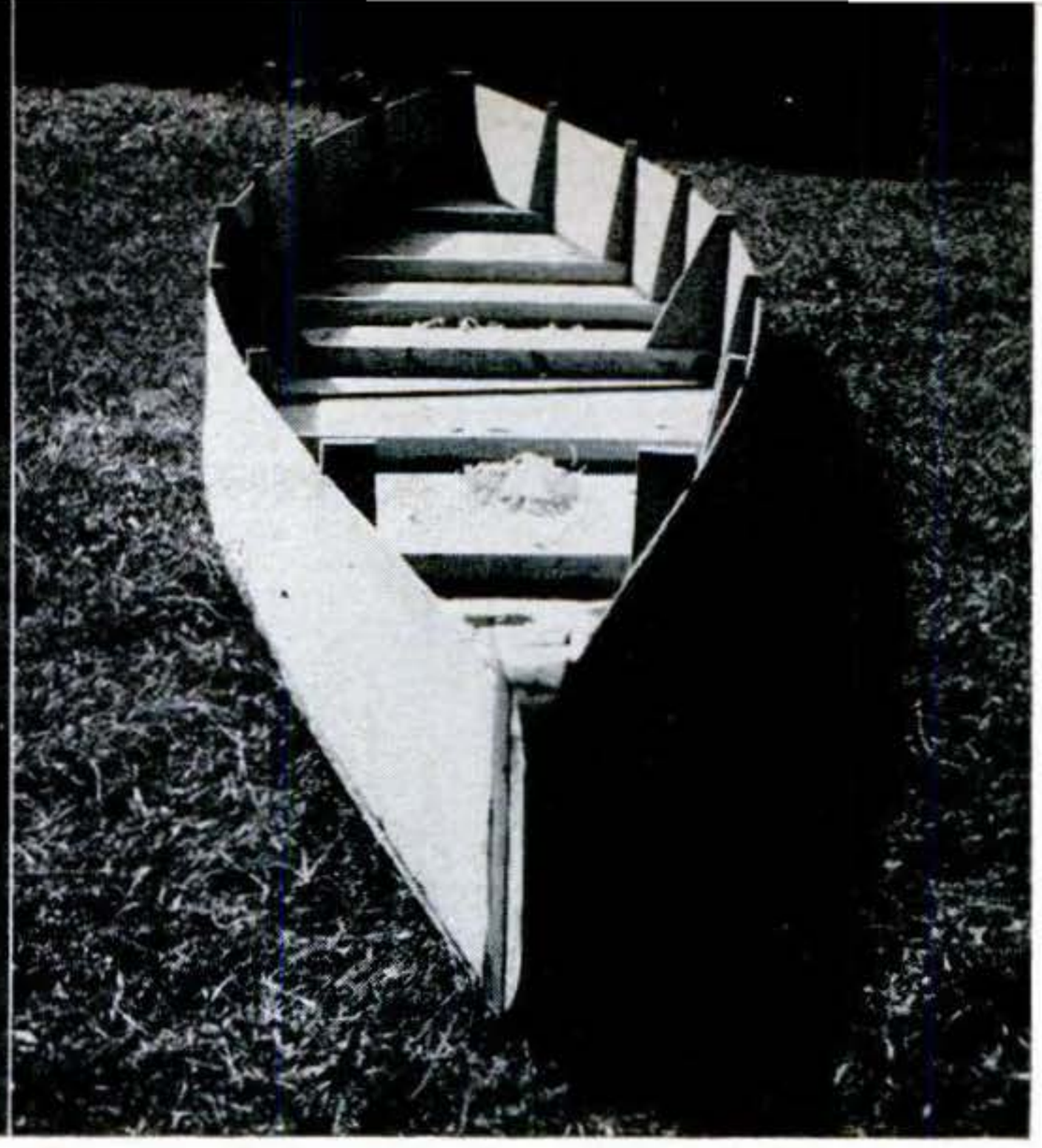
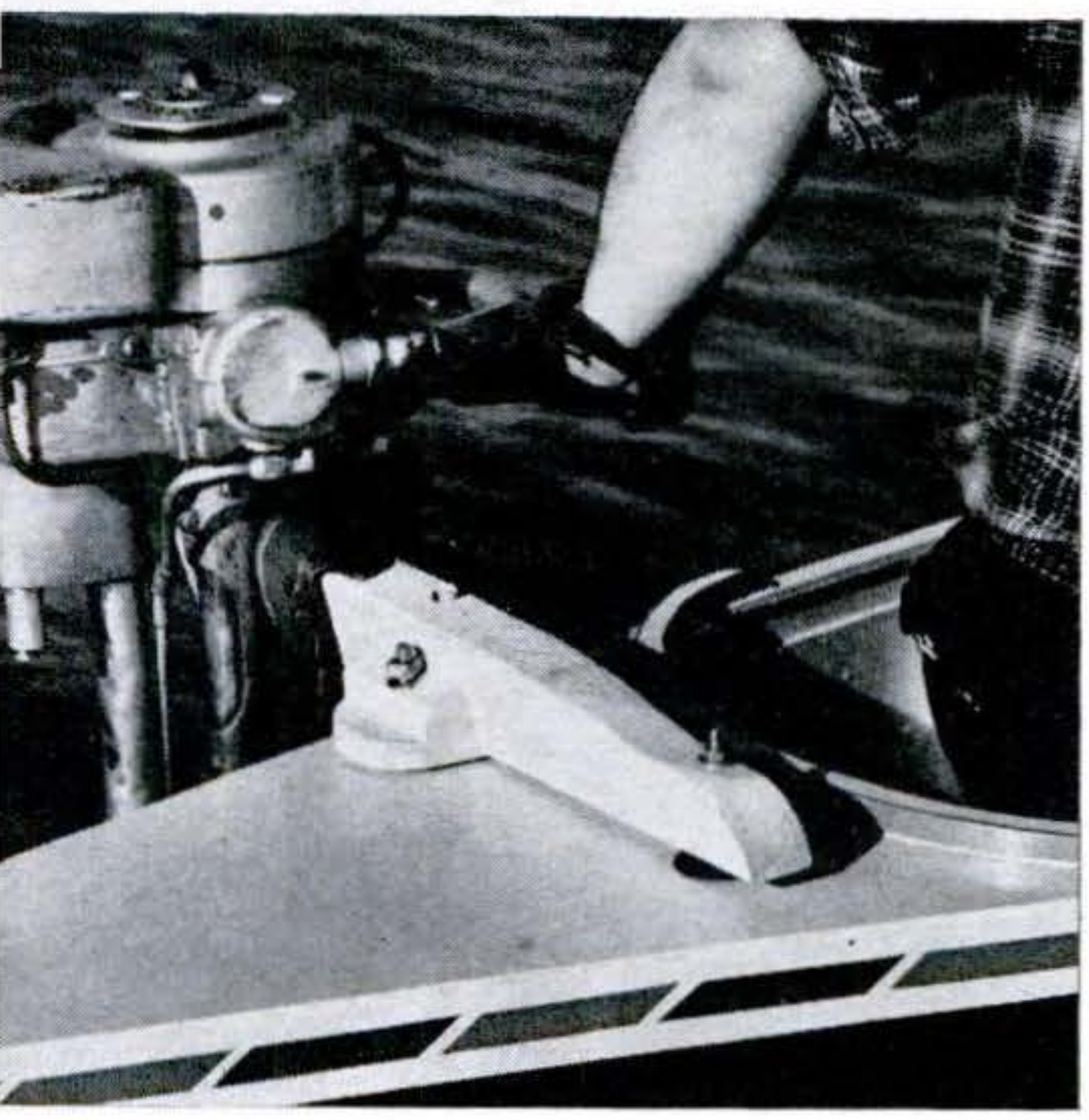
Best seam job is made by routing a shiplap joint between the two bottom panels. Rout lower surface of one panel, the upper surface of the other. Mount first the panel that has its lower surface routed.



After one day's work, the original hull looked like this. All frames are in place, false stem and cutwater attached. Ends of siding must be shaved flush with stem, using plane or Surform.



sions shown in the sketch. A pint of spar varnish will give three-coat natural finish to the cedar sides. Two-and-a-half quarts of exterior enamel are enough for the remainder of the hull, inside and out.

tographs) to keep them from moving.

Before attaching the clapboards to the midframe, mark the midpoint of both boards with a perpendicular pencil line on the inside surface (which may require a little sanding). Draw a parallel line on each side of it about ½″ away. These will be guides when the midline is coated with glue. Brush a glue stripe about ½″ wide along the midline from edge to edge of each board. Also glue-coat the outer edges of the midframe's vertical members. Fasten each clapboard to the frame (at midpoint) with two 1¼″ copper nails, leaving the heads temporarily above the surface.

The horizontal bottom member of the frame should be ¼″ up from the ¾″ bottom edges of the clapboards. This allows for the ¼″ plywood butt strip that will be under the frame.

Immediately—before the glue starts to set—bring the clapboards together at one end, drive a nail to hold the ends even, and tie them with twine. Bend the other ends until they meet; tie and nail them.

The stems. These should be cut in advance. Loosen the cord slightly at one end of the clapboards, and pull out the nail (the other end will hold things in line). Set the stem in place and press the clapboard ends against it. If it's a little off angle on its beveled surfaces, trim it to fit with a block plane.

When fitted, glue-coat all meeting surfaces of stem and clapboards, and fasten with three 1½″-#8 flathead brass screws on each side. Be sure the front surface of the stem is even with the ends of the clapboards. If it isn't, your stem will be tipped to one side. A couple of brads can be handy here if the stem tends to slide in the glue. They'll hold things in place until you tighten the screws. Do the same job at the other end, and your hull is ready for the plywood bottom. Both stems, unlike the midframe, should be flush with the ¾″ clapboard edge.

[Continued on page 176]

Please turn the page for lie-flat blueprint

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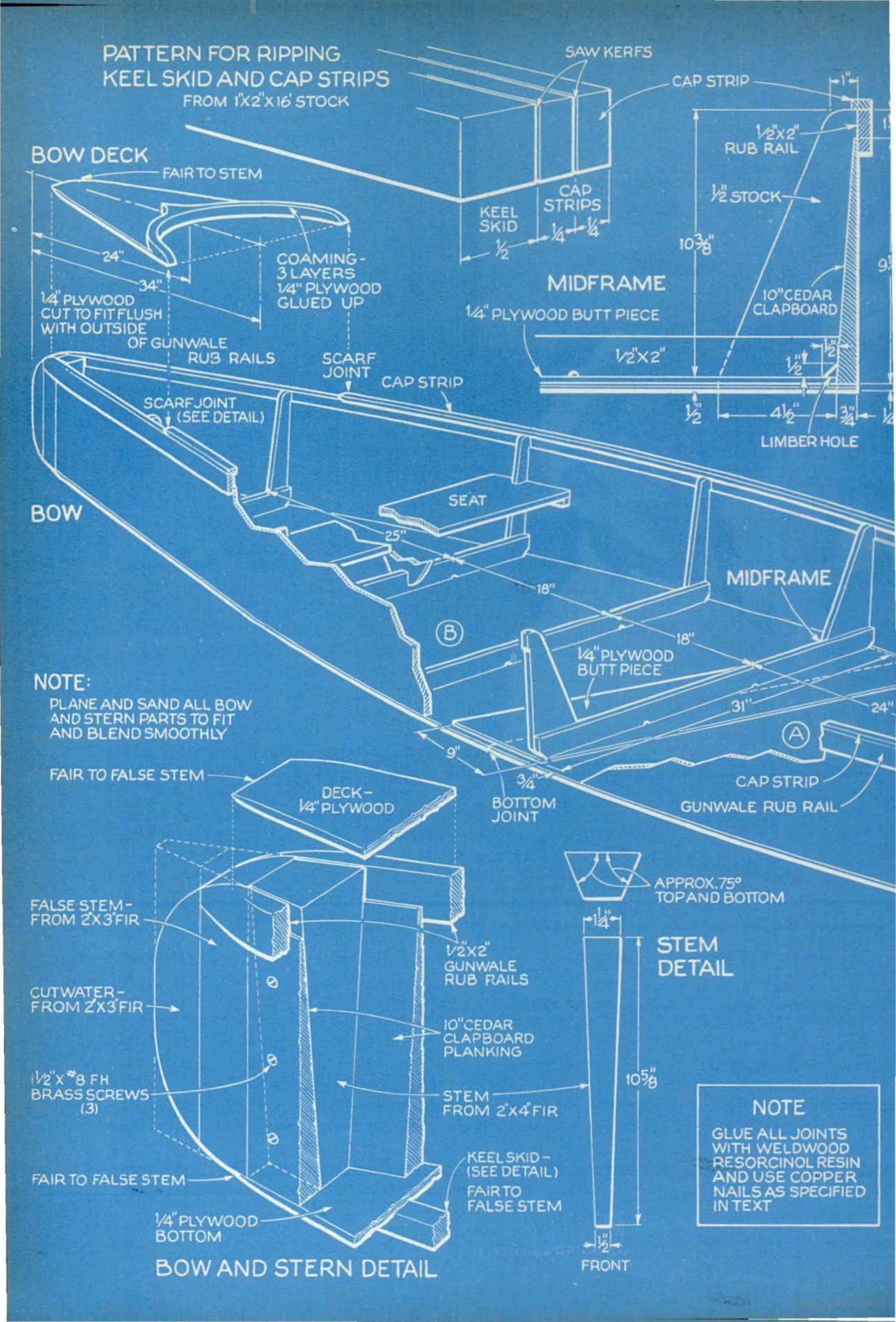
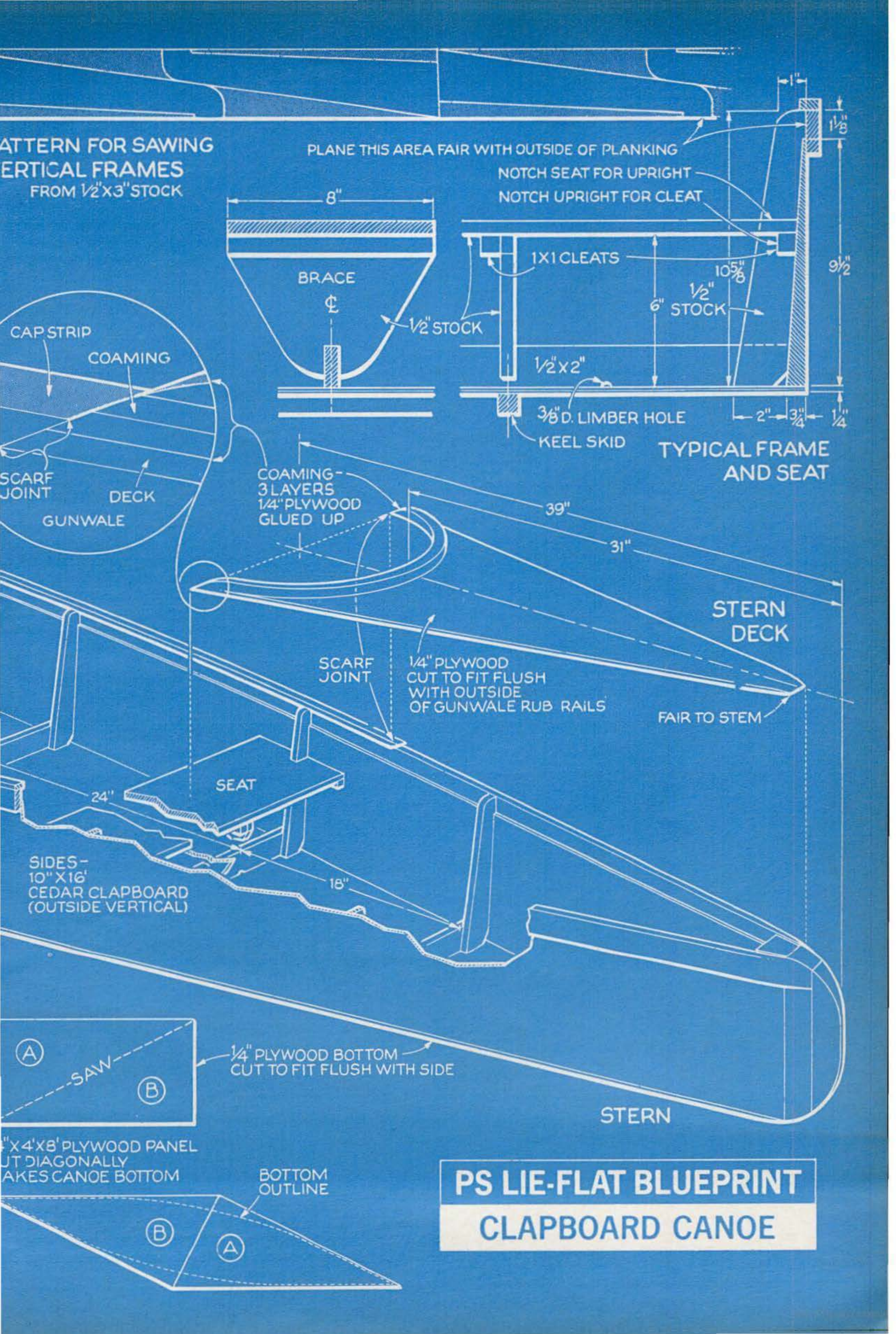

PATTERN FOR RIPPING KEEL SKID AND CAP STRIPS
FROM 1"X2"X16' STOCK
SAW KERFS
CAP STRIP
KEEL SKID
CAP STRIPS
1/2
1/4
1/4
BOW DECK
FAIR TO STEM
24"
34"
1/4" PLYWOOD CUT TO FIT FLUSH WITH OUTSIDE OF GUNWALE RUB RAILS
COAMING - 3 LAYERS 1/4" PLYWOOD GLUED UP
SCARF JOINT
CAP STRIP
SCARF JOINT (SEE DETAIL)
BOW
SEAT
25"
18"
MIDFRAME
18"
1/4" PLYWOOD BUTT PIECE
31"
24"
9"
3/4"
BOTTOM JOINT
CAP STRIP
GUNWALE RUB RAIL
1/2"X2" RUB RAIL
1/2" STOCK
10 3/8"
10" CEDAR CLAPBOARD
1/4" PLYWOOD BUTT PIECE
1/2"X2"
1/2"
4 1/2"
3/4"
LIMBER HOLE
NOTE:
PLANE AND SAND ALL BOW AND STERN PARTS TO FIT AND BLEND SMOOTHLY
FAIR TO FALSE STEM
DECK - 1/4" PLYWOOD
FALSE STEM - FROM 2"X3" FIR
1/2"X2" GUNWALE RUB RAILS
CUTWATER - FROM 2"X3" FIR
10" CEDAR CLAPBOARD PLANKING
1/2" X #8 FH BRASS SCREWS (3)
STEM FROM 2"X4" FIR
KEEL SKID - (SEE DETAIL)
FAIR TO FALSE STEM
FAIR TO FALSE STEM
1/4" PLYWOOD BOTTOM
BOW AND STERN DETAIL
APPROX. 75° TOP AND BOTTOM
1 1/4"
STEM DETAIL
10 5/8"
1/2"
FRONT
NOTE
GLUE ALL JOINTS WITH WELDWOOD RESORCINOL RESIN AND USE COPPER NAILS AS SPECIFIED IN TEXT


ATTERN FOR SAWING
ERTICAL FRAMES
FROM 1/2"X3" STOCK
PLANE THIS AREA FAIR WITH OUTSIDE OF PLANKING
NOTCH SEAT FOR UPRIGHT
NOTCH UPRIGHT FOR CLEAT
8"
BRACE
℄
1/2" STOCK
1X1 CLEATS
10 5/8"
1/2" STOCK
6"
9 1/2"
1"
1 1/8"
1/2"x2"
3/8" D. LIMBER HOLE
KEEL SKID
2"
3/4"
1/4"
TYPICAL FRAME
AND SEAT
CAP STRIP
COAMING
SCARF
JOINT
DECK
GUNWALE
COAMING-
3 LAYERS
1/4" PLYWOOD
GLUED UP
39"
31"
STERN
DECK
SCARF
JOINT
1/4" PLYWOOD
CUT TO FIT FLUSH
WITH OUTSIDE
OF GUNWALE RUB RAILS
FAIR TO STEM
SEAT
24"
SIDES-
10" X 16'
CEDAR CLAPBOARD
(OUTSIDE VERTICAL)
18"
A
SAW
B
1/4" PLYWOOD BOTTOM
CUT TO FIT FLUSH WITH SIDE
STERN
"X4'X8' PLYWOOD PANEL
UT DIAGONALLY
AKES CANOE BOTTOM
BOTTOM
OUTLINE
B
A
PS LIE-FLAT BLUEPRINT
CLAPBOARD CANOE

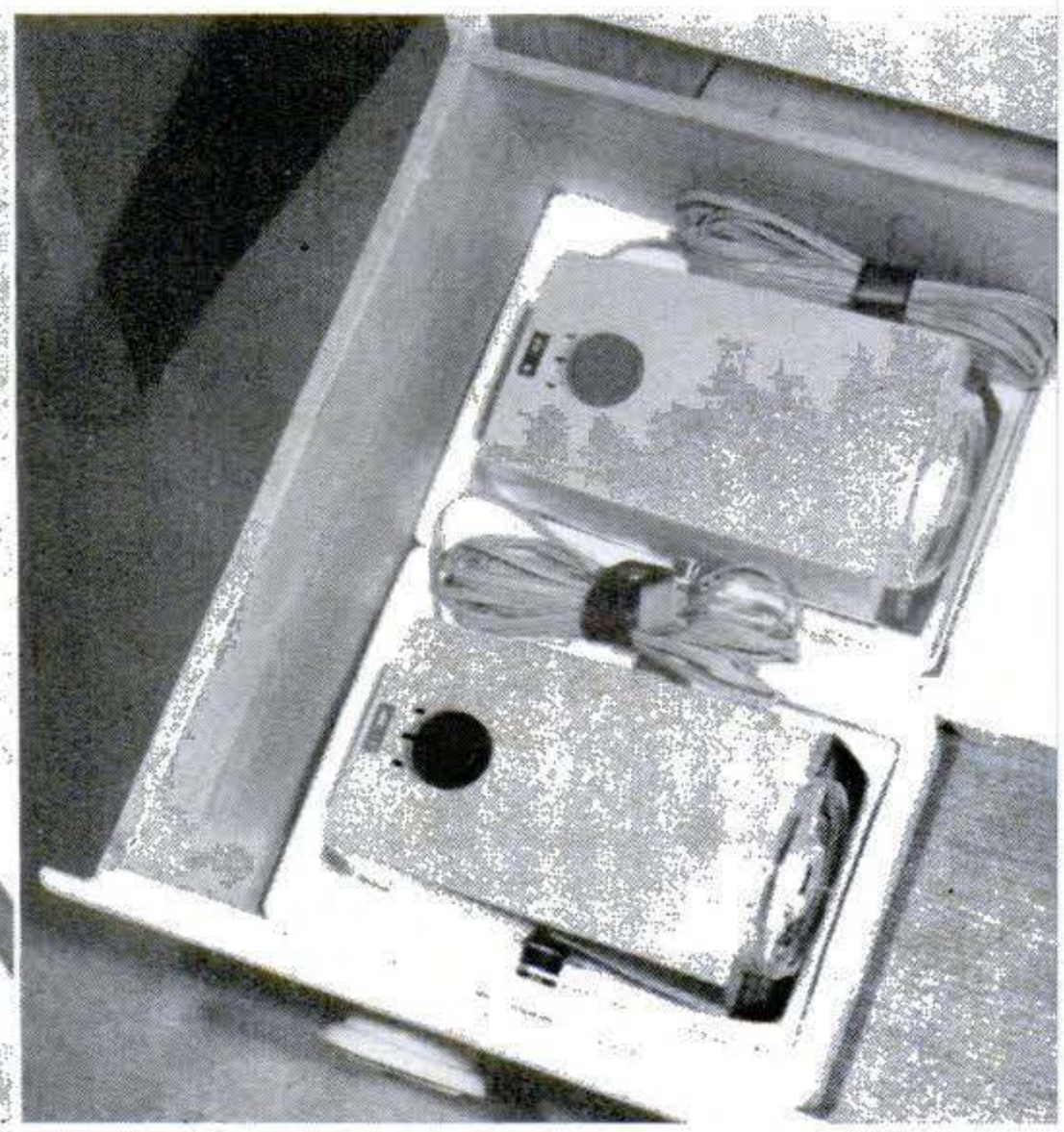
7 Goo

WINTER WORKSHOP IDEA 58

The right temperatu The rinse water I u between developer a fixer is always at exac the same temperature as the che icals since I started using t trick: I store a gallon bottle water right along with them on darkroom shelf. At the end of ea film-developing session, I refill t bottle for the next session.—*Jo Seginski, Redwood City, Calif.*

WINTER WORKSHOP IDEA 59

Dowel aids agitation. make agitation eas when I'm developing fixing prints, I put piece of dowel under each tray. I easy then to roll the tray back a forth without danger of spilling. round pencil, of course, will do t same thing.—*Robert E. Callend Columbus, Ohio.*



WINTER WORKSHOP IDEA 61

Film tubes solve the cord problem. Don't throw away those cardboard tubes in which 35mm black-and-white cartridges come packed. They're just the thing to keep flash and power cords from getting entangled in your gadget bag. They're handy, too, when the cord is in use: Fold up the excess and slide it into the tube.—*Lancey A. Cascaden, Grand Forks, N.D.*

WINTER WORKSHOP IDEA 62

Styrofoam nests for equipment. Whe you buy new lighting equipment, or oth fragile photo accessories, save the foan plastic packing material. It makes a goc storage "rack." Setting each item in its own custor made nest in a drawer, for example, keeps uni from banging against each other as the drawer opened or closed.—*M. Lincoln, Wickenberg, Ari*

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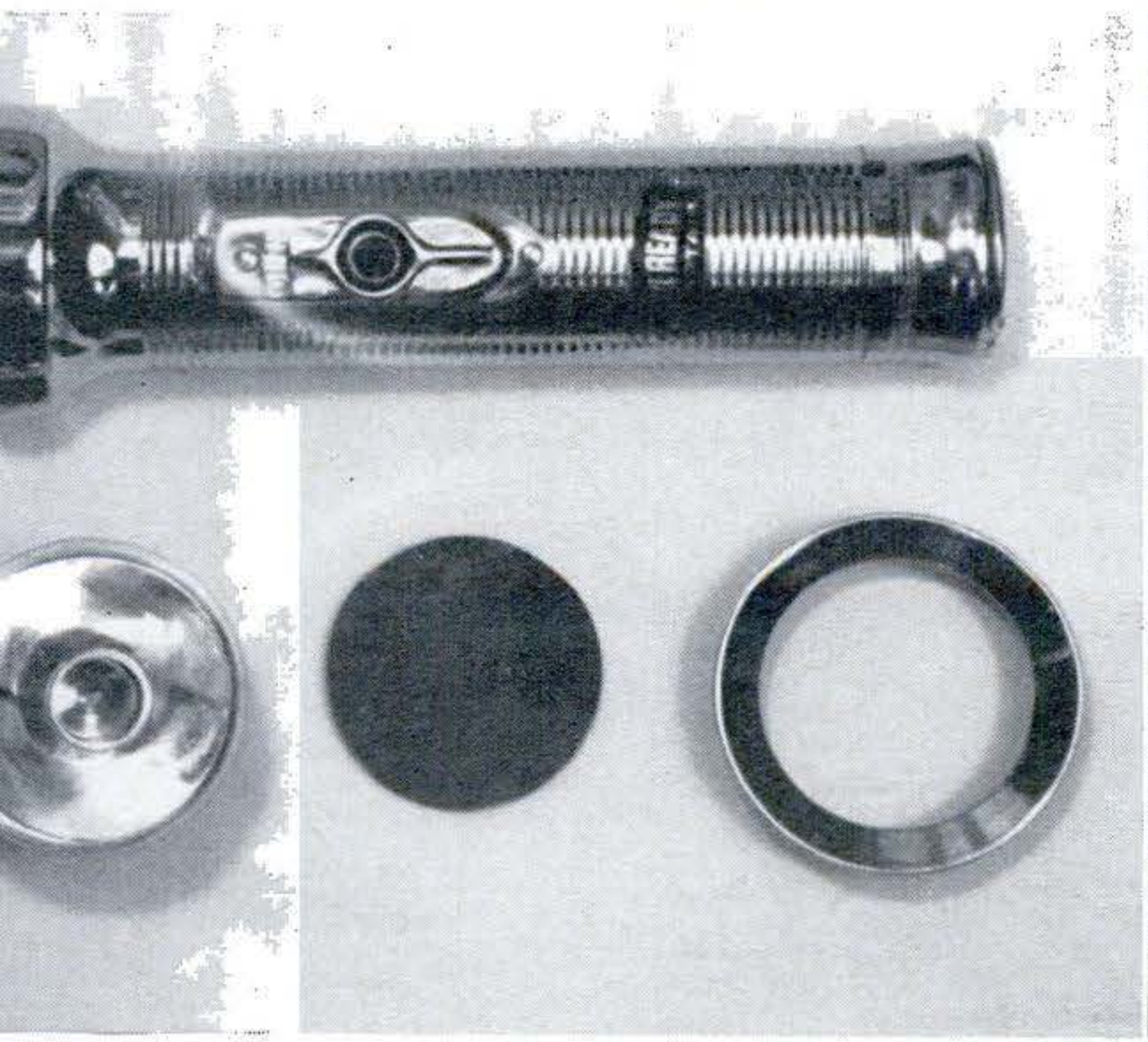
Ideas for Photographers

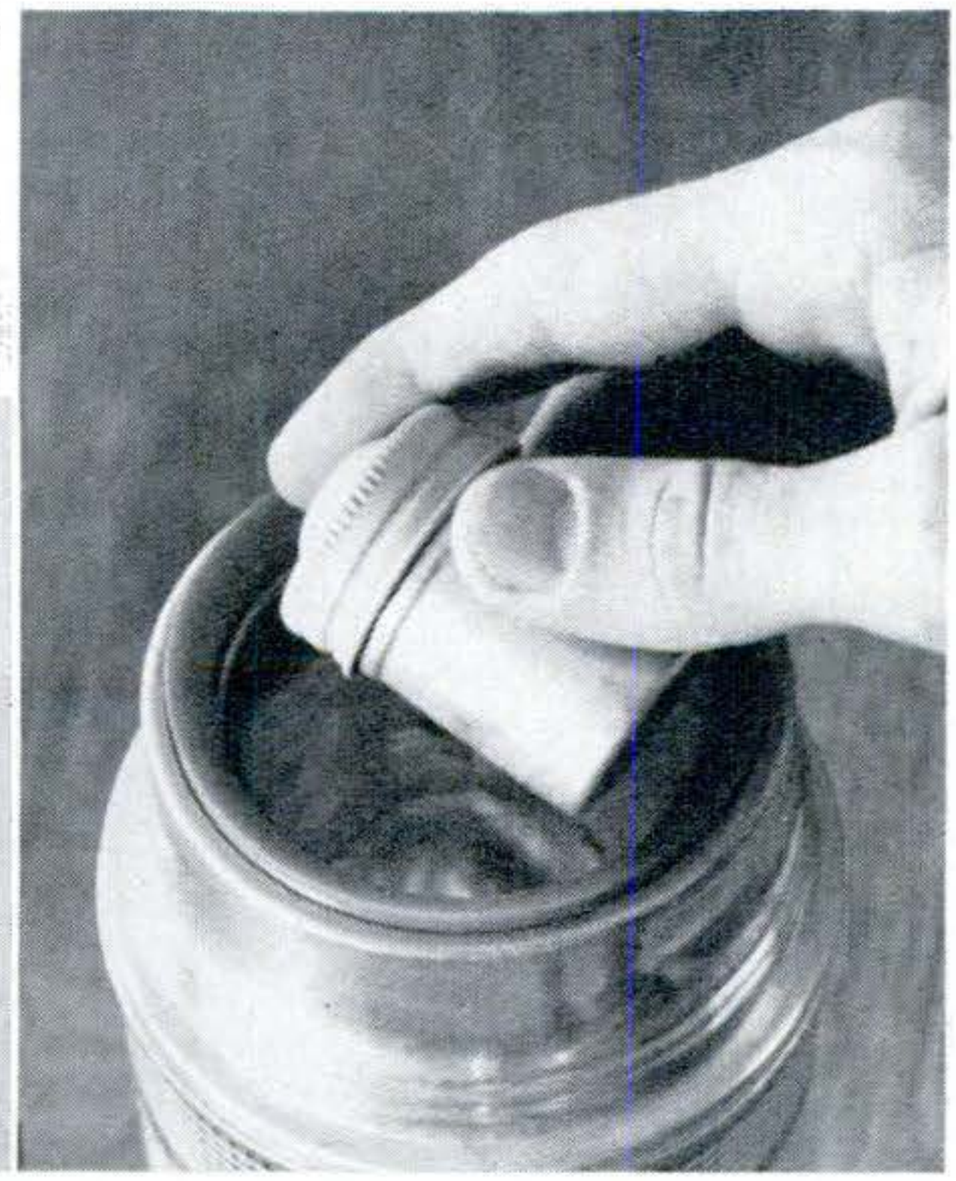
WINTER WORKSHOP IDEA 60

Focusing tip. You'll never start showing home movies with your projector out of focus if you use my simple system: With an etching knife, I scribe a line down the center of each reel leader (on the coated side). The knife, held to produce a scraping action, leaves a transparent line, the irregular edges of which act as "images." When the projector is out of focus, the line is indistinct. As you bring the projector into focus, the jagged edges of the line become sharp and clear. When the pictures appear, you're all set.—*W. E. Burton, Akron, Ohio.*



WINTER WORKSHOP IDEA 63

Make your own darkroom flashlight. That old red filter you have kicking around can be put to good use as a replacement for a flashlight lens. The result is a portable safelight that can be used in e darkroom to hunt for lost items without taking time to ıt enlarging paper away and turn on the white light. A few yers of red cellophane over the lens may do the job, too. *Lancey A. Cascaden, Grand Forks, N.D.*



WINTER WORKSHOP IDEA 64

How to keep color film cool. Here's an easy way to keep color film cool during summer heat. All it takes is a wide-mouthed vacuum bottle. Put the bottle in the refrigerator overnight. Before starting on a trip, insert the films (in their containers, or waterproof packing).—*Lancey A. Cascaden, Grand Forks, N.D.*

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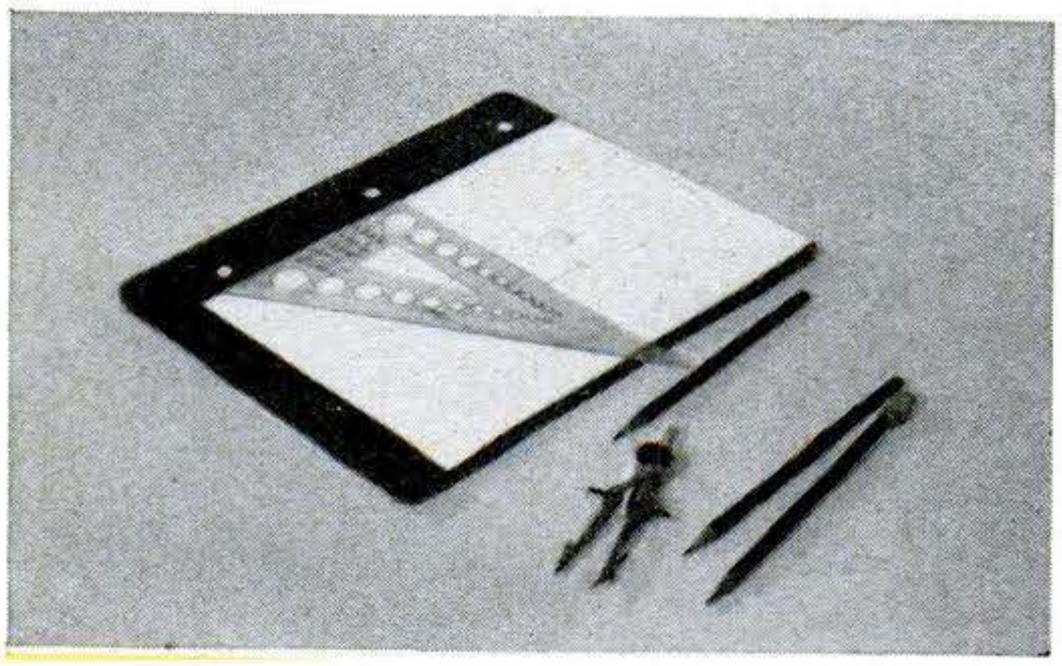
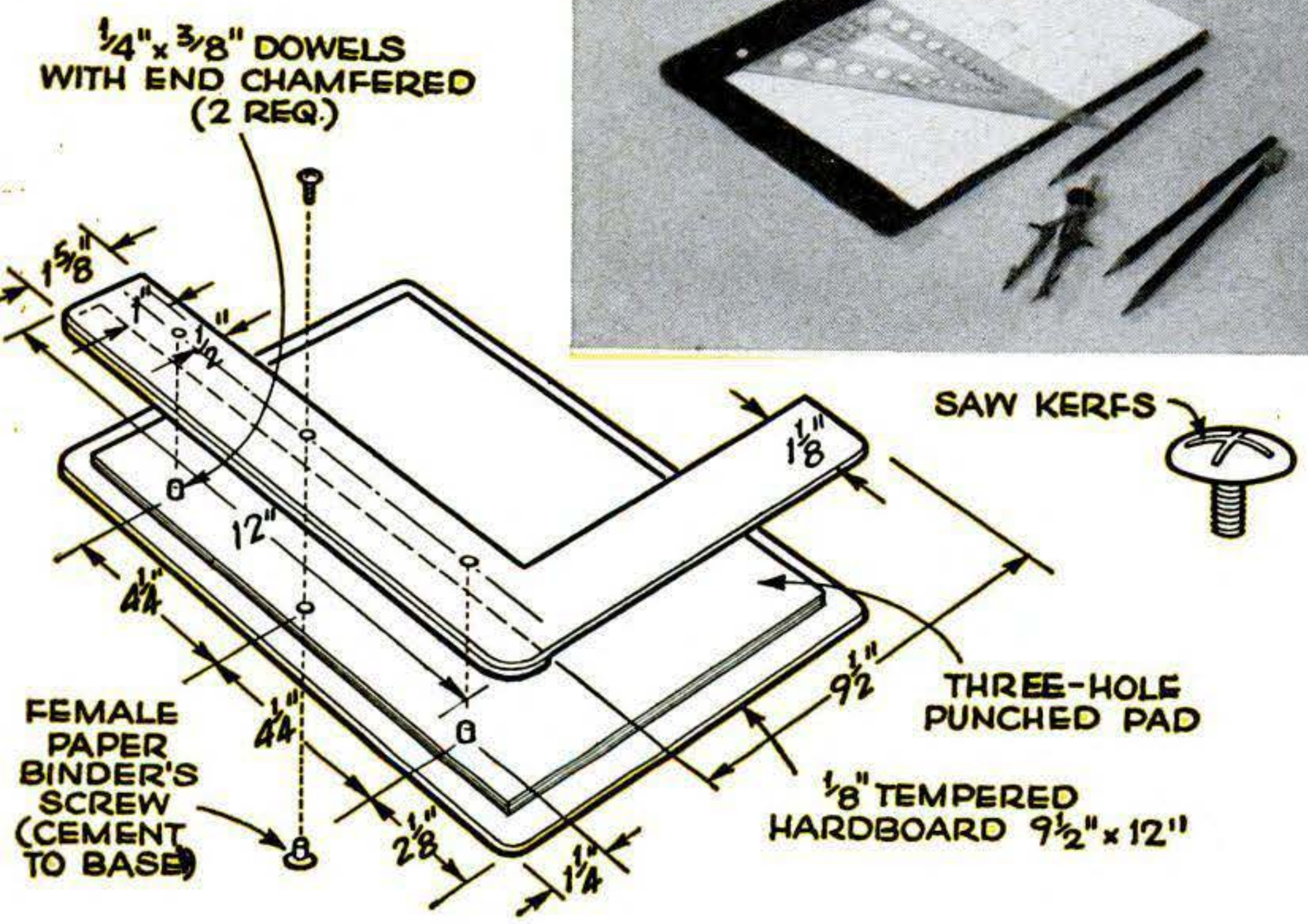
7 Good Things to

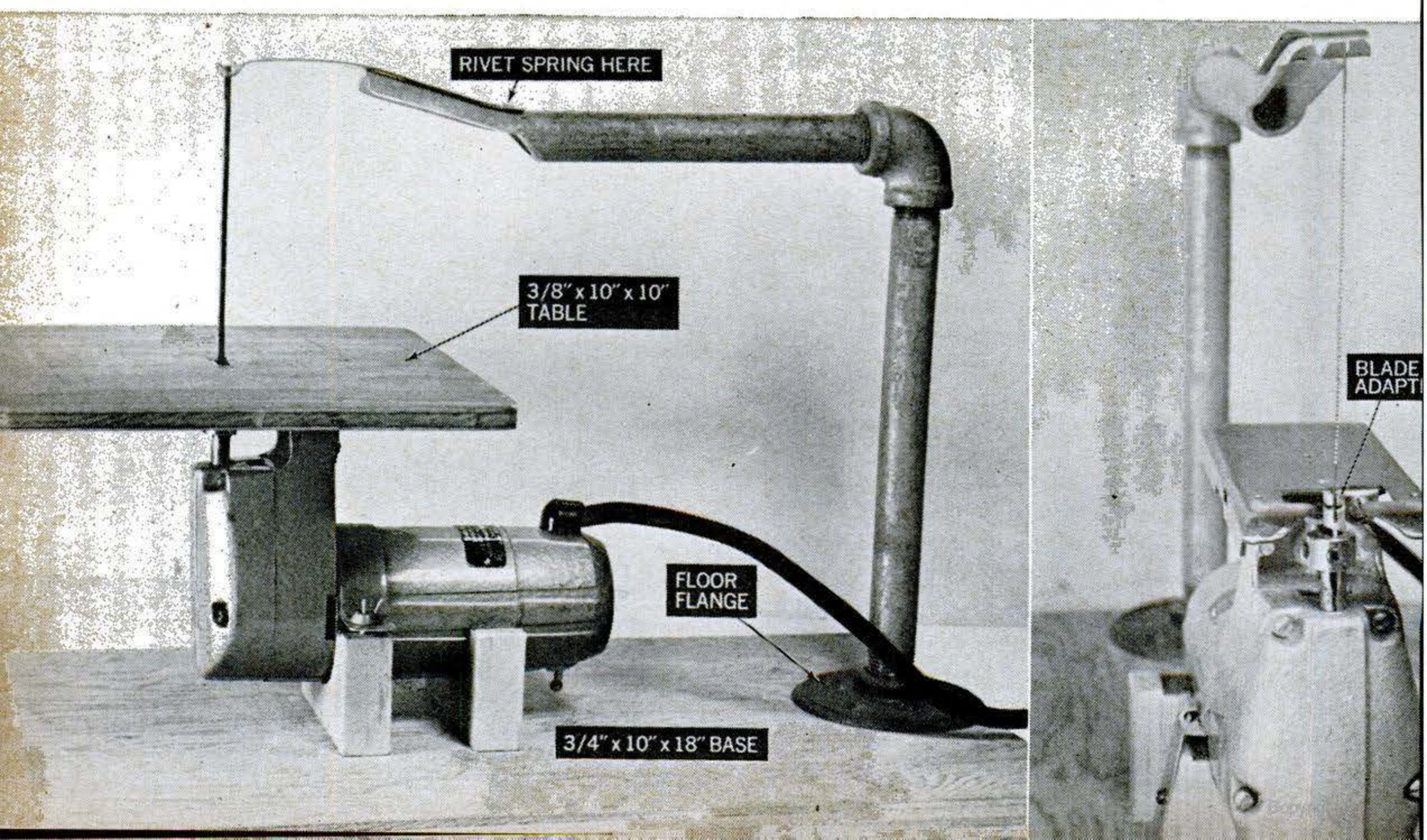




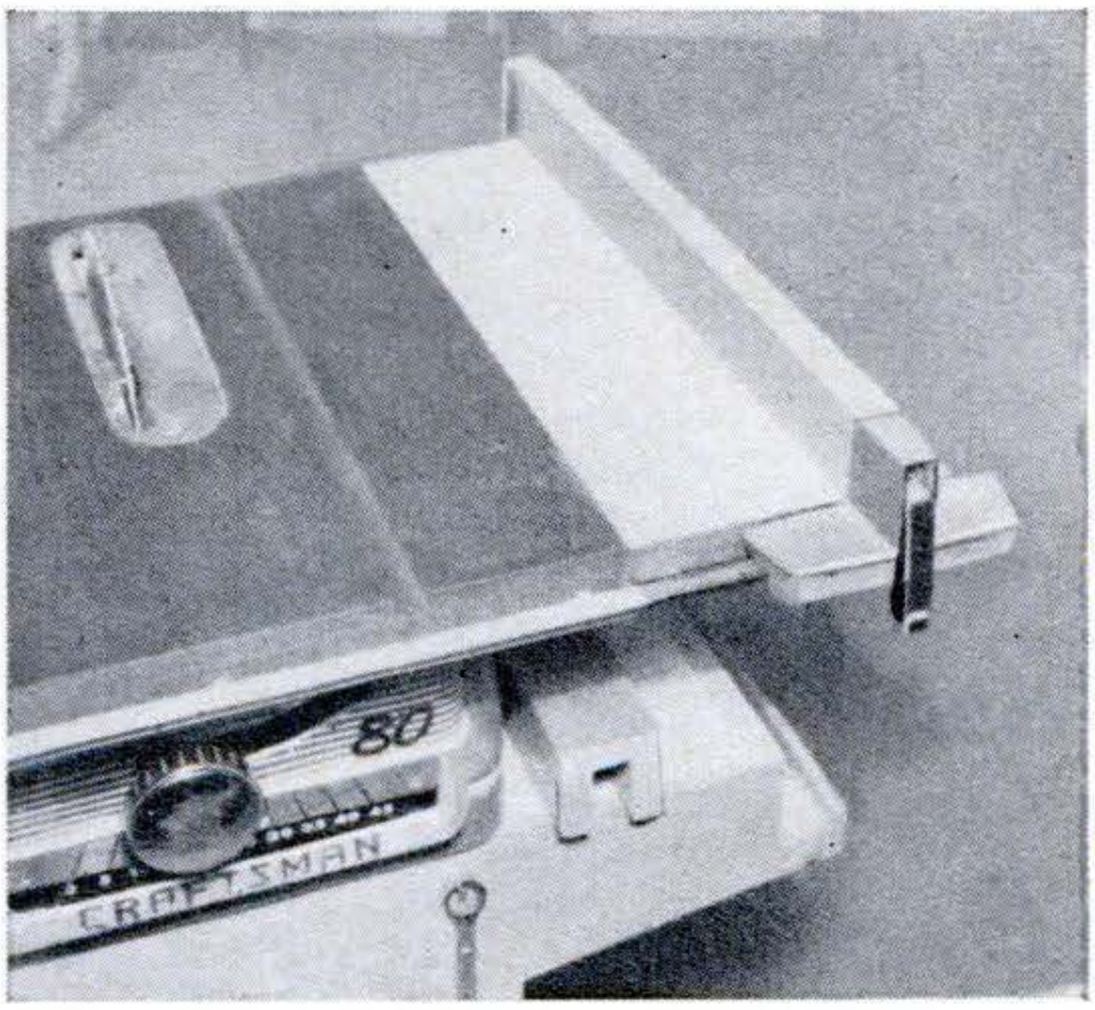
Here's a drafting clipboard

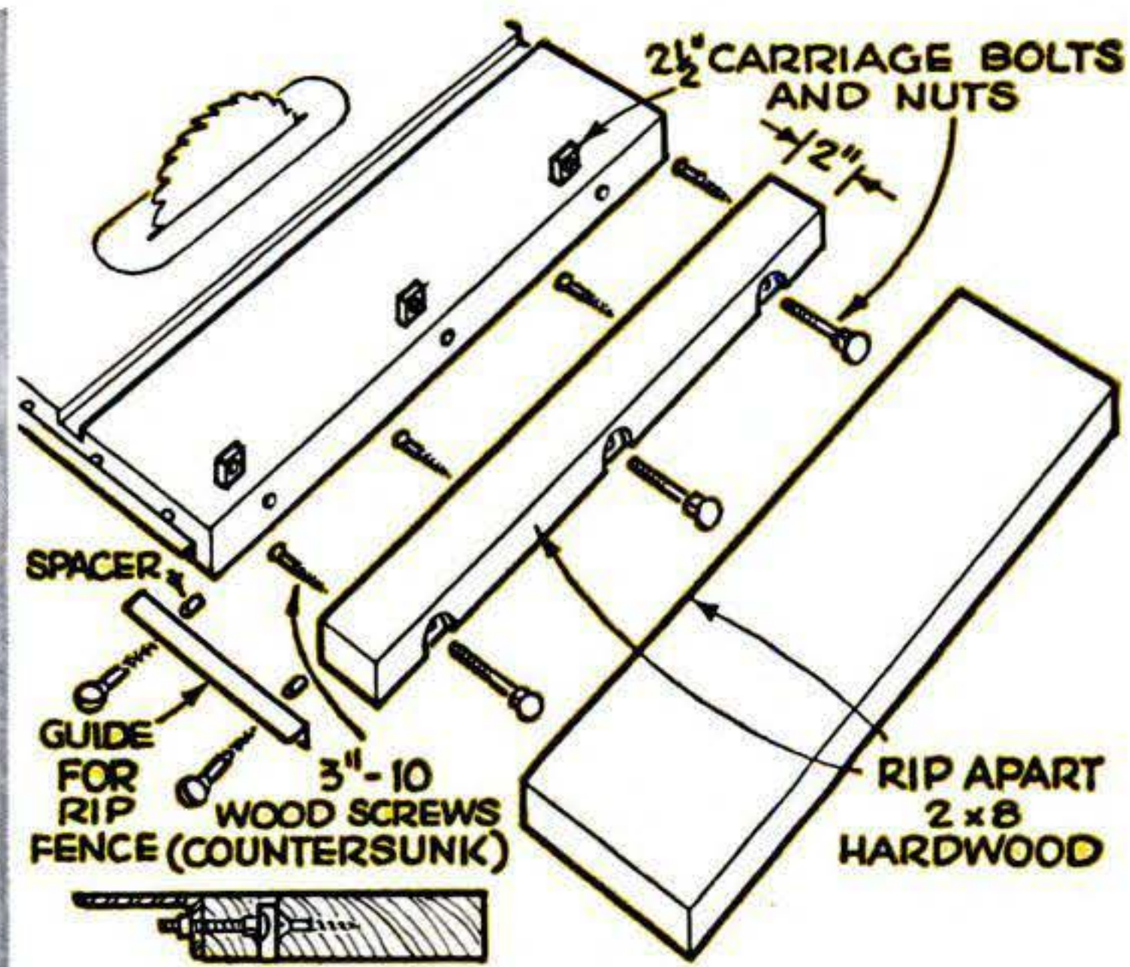
WINTER WORKSHOP IDEA 65

For on-the-spo drafting in the sho or even outdoors, th board plus two triangles serve admirably. It takes standar three-hole paper, and the pin index sheets precisely fo overlays and tracings. Cut th right-angled piece of 1/8" tem pered hardboard the same siz outside as the base, but glue second 5/8"-wide strip to th left edge to raise the righ angled piece from the bas Be sure that the inner edge are at exactly 90 degrees t each other, and the three hole parallel to the long edge. Ce ment the chamfered dowels i place. Sink the female screw flush with the bottom and ce ment it also.—*Robert F. Finch Thousand Oaks, Calif.*



Make for Your Shop



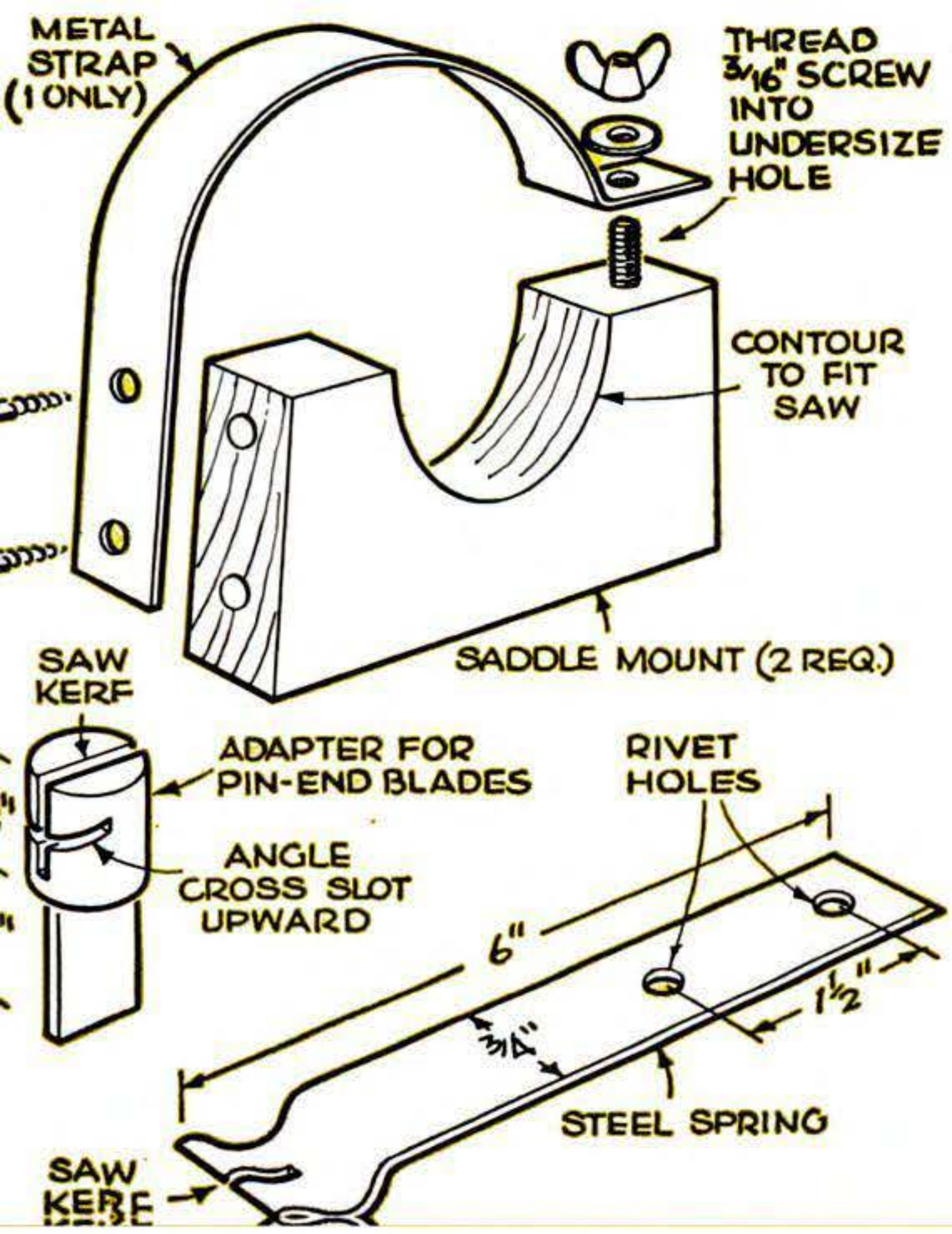


You'll swear by this saw-table extension every time you cut the big stuff

WINTER WORKSHOP IDEA 66

To enlarge a saw table for handling big work, you can quickly make this extension from a piece of two-by-eight hardwood. The edge that will go against the saw table must be jointed square before ripping 2" off that side. Mark matching ends of both pieces and lay out holes for the bolts and screws. Countersink. Insert the bolts, apply glue to both edges, and drive the screws. Attach the extension to the table. Make the fence-guide extension of bar or angle stock, set on spacers.

Continued



Adapter turns saber saw into a jigsaw

WINTER WORKSHOP IDEA 67

A big-capacity jigsaw is yours with this saber-saw setup. With the saw in place on the two mounts, measure for two pieces of pipe to make an overarm that will permit using blades 5" long. Saw the horizontal pipe lengthwise for 3" and remove the bottom half. The blade spring can be made from a cheap keyhole saw. To soften it for drilling, heat that area red hot and let it cool slowly. For rehardening, heat to redness and quench in water. Brighten with abrasive, heat until it is blue, and quench to temper. An abrasive wheel in a hand grinder will cut the slot in the other end without first softening the metal. Bend up the overarm to provide a pull of eight to 10 pounds. Fasten the table to the saw shoe with three #6-32 countersunk machine screws. Drill and tap holes for them. If the shoe can be tilted, lengthen the blade hole in the table to add this feature to the saw setup.—*Howard W. Teter, Menlo Park, Calif.*

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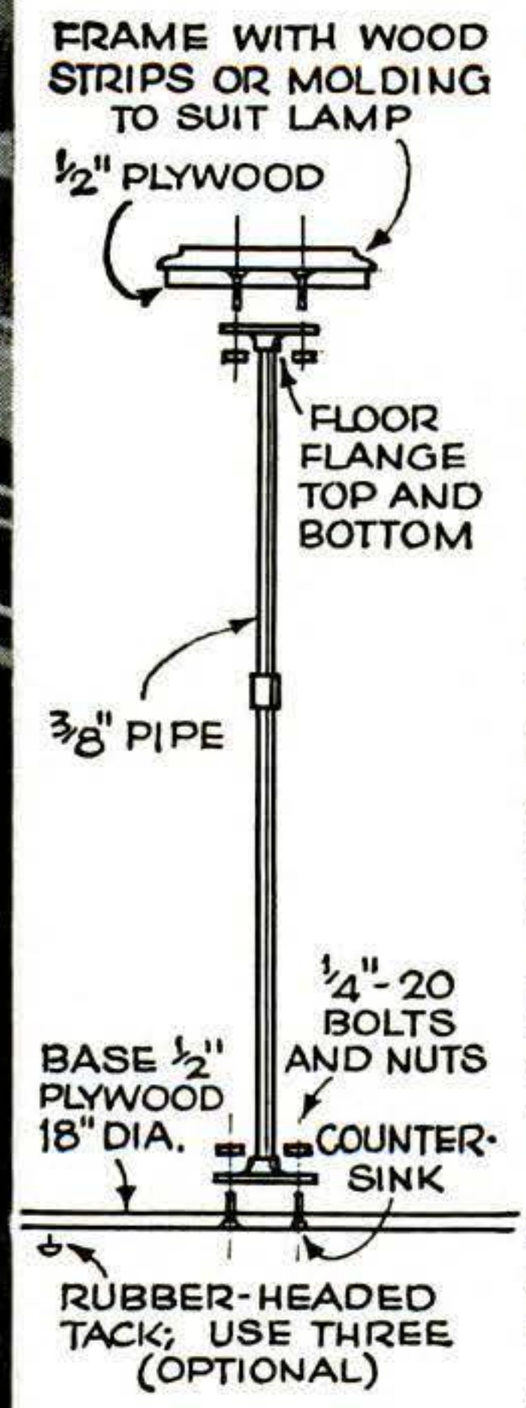
Movable stand spotlights the work

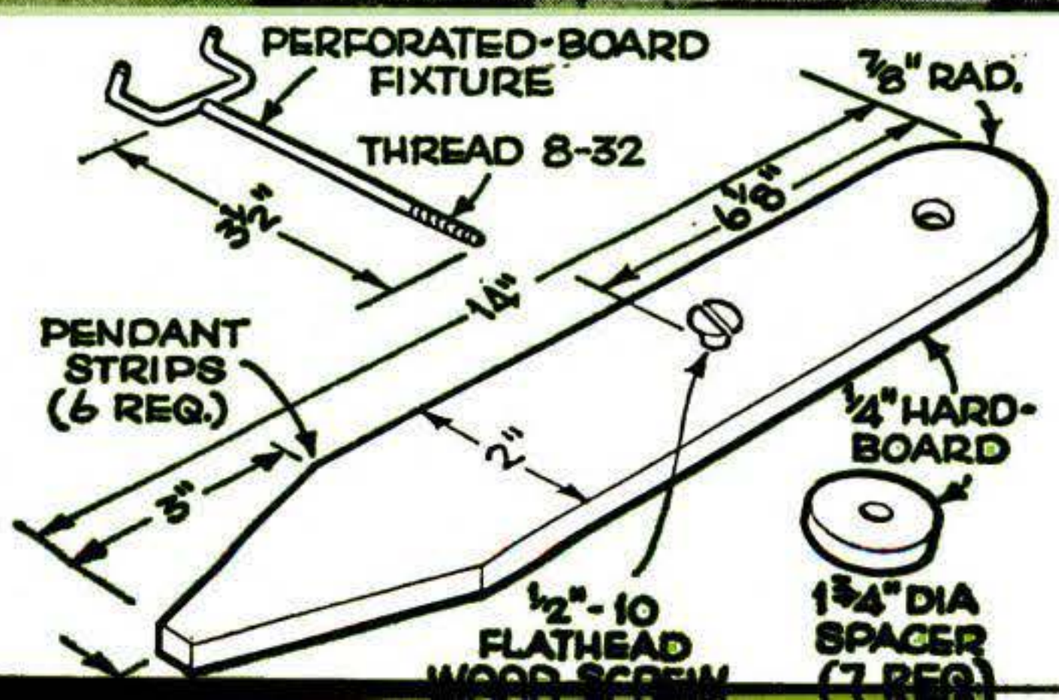


WINTER WORKSHOP IDEA 68

You can multiply the shop usefulness of a conventional high-intensity lamp by making a stand for it. It lets you take the lamp off the workbench and place it near any job on the shop floor. A solid, nontipping stand can be made using ⅜" pipe with a connecting flange at each end, a base of ½" plywood, and a holder at the top made to conform to the size and shape of the lamp base. The holder in the photograph is made of 1⅝" base molding mitered at the corners. A notch sawed and chiseled from the front of the holder accommodates the switch, and a similar notch in the rear is for the cord.

The stand's height is determined by the height of the sawhorses or shop tables you work with. A coupling in the pipe makes for easy adjustment.—*W.B. Sill, NYC.*

Swinging storage rack puts the circular-saw blade you want right at your fingertips



WINTER WORKSHOP IDEA 69

Saw blades are stacked compactly on this swinging rack but cannot touch each other. You can swing out any desired blade without disturbing any of the others.

Using 14" pendant strips as shown, the rack holds blades up to 10" in diameter. If your largest is only 8", cut the strips 12" long, or for 12" blades, 16". Rip ½" hardboard 2" wide and cut six pieces to length. Clamp them and drill a small hole ⅞" from one end. Use this to scribe the top curve. In each piece, drill a pilot hole for a ½"- 10 flathead wood screw. Drive this until the point pierces the back, letting ¼" protrude for the blade to hang on. The screwhead taper will hold it securely. A circle cutter offers the quickest way to cut the seven spacers.

Open out all holes to ¼" if you mount the rack against a wall with a 4½" screw bolt. To hang it on perforated board, cut a fixture 3½" long and thread the end. Set the fixture in place. Slip on a spacer and a pendant member, alternating until all are assembled. (The fixture can't be hung if you assemble the rack first.) Add a washer and tighten on a nut to permit free action.—*William G. Waggoner, Sacramento, Calif.*

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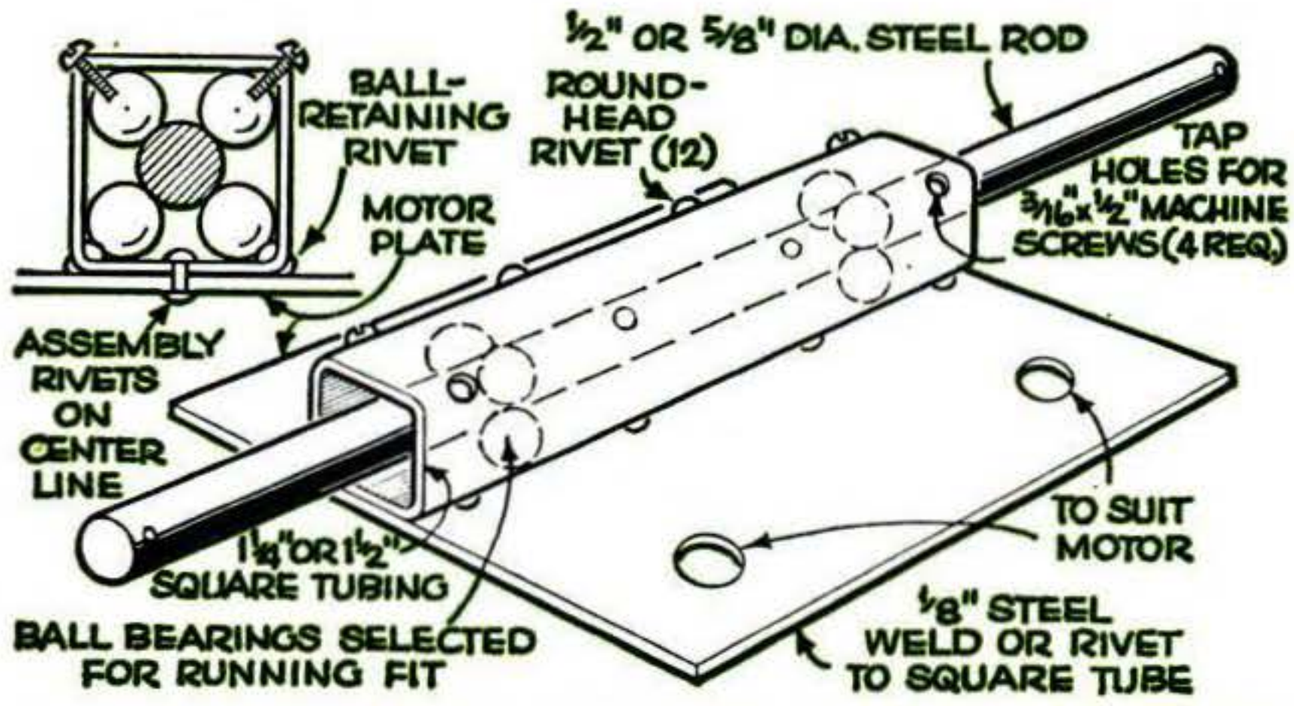
Ball-bearing motor mount makes it easier to tilt your table saw

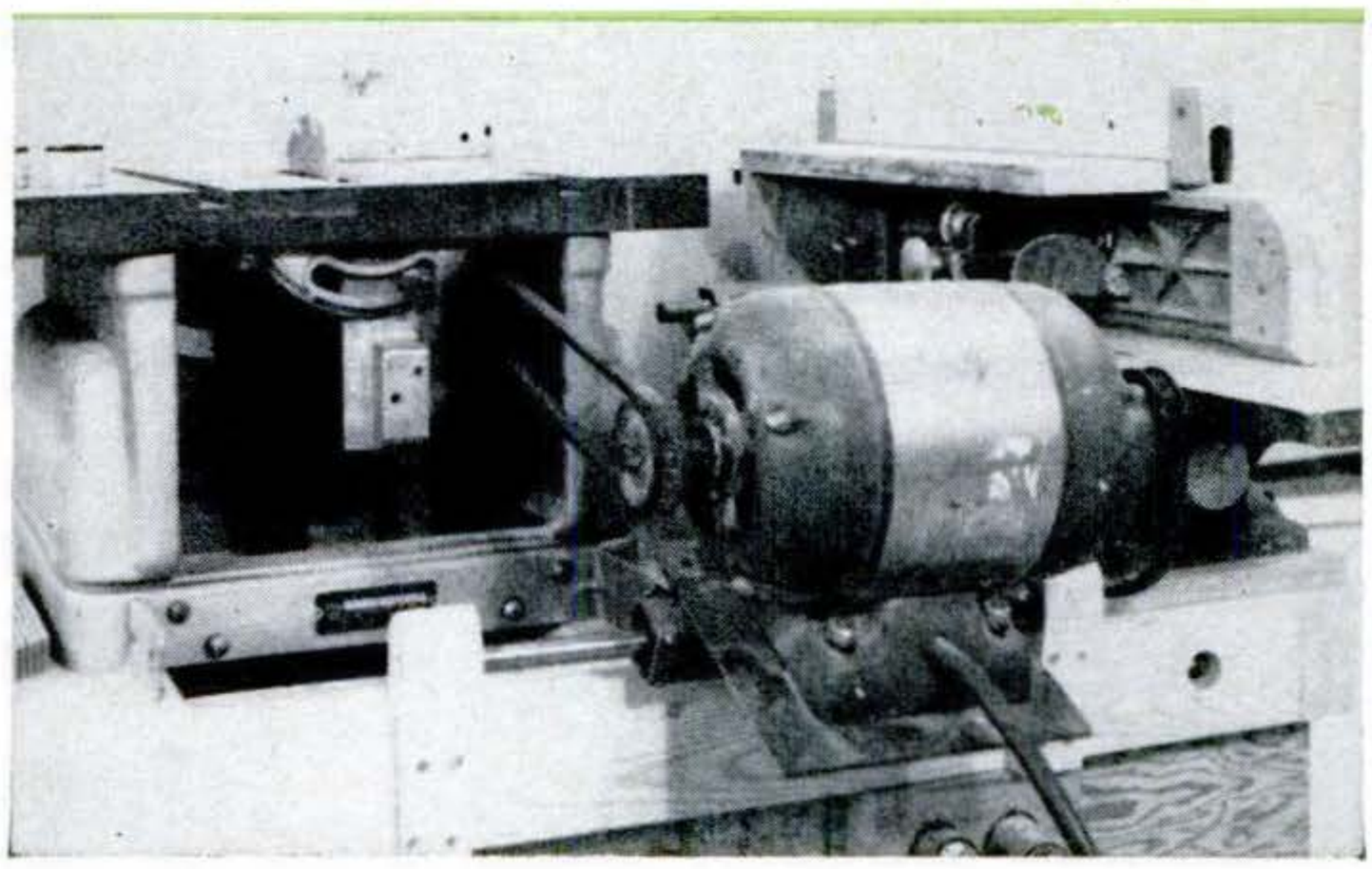
WINTER WORKSHOP IDEA 70

Tilt adjustment is easier, on table saws requiring lateral motor movement for that purpose, if you make and install this mount. It replaces the sleeve-bearing slide and follower arm furnished for such saws, is free-running, self-cleaning, needs no lubing.

To size the mount, figure on sliding movement twice as long as the ball travel. In a length of square steel tubing, drill 12 holes at the corners and drive in short rivets. Then weld or rivet the tubing to the motor plate; spot rivets along the center of the tubing for free ball movement.

Tap four holes at the outer corners and cut a steel rod to fit your support brackets. Choose eight bearing balls that are a loose fit against the rod. Feed the last ones in past the tapped holes; then drive in four screws to retain them.





Easily made guide for portable belt sander keeps those edges square when you sand them

WINTER WORKSHOP IDEA 71

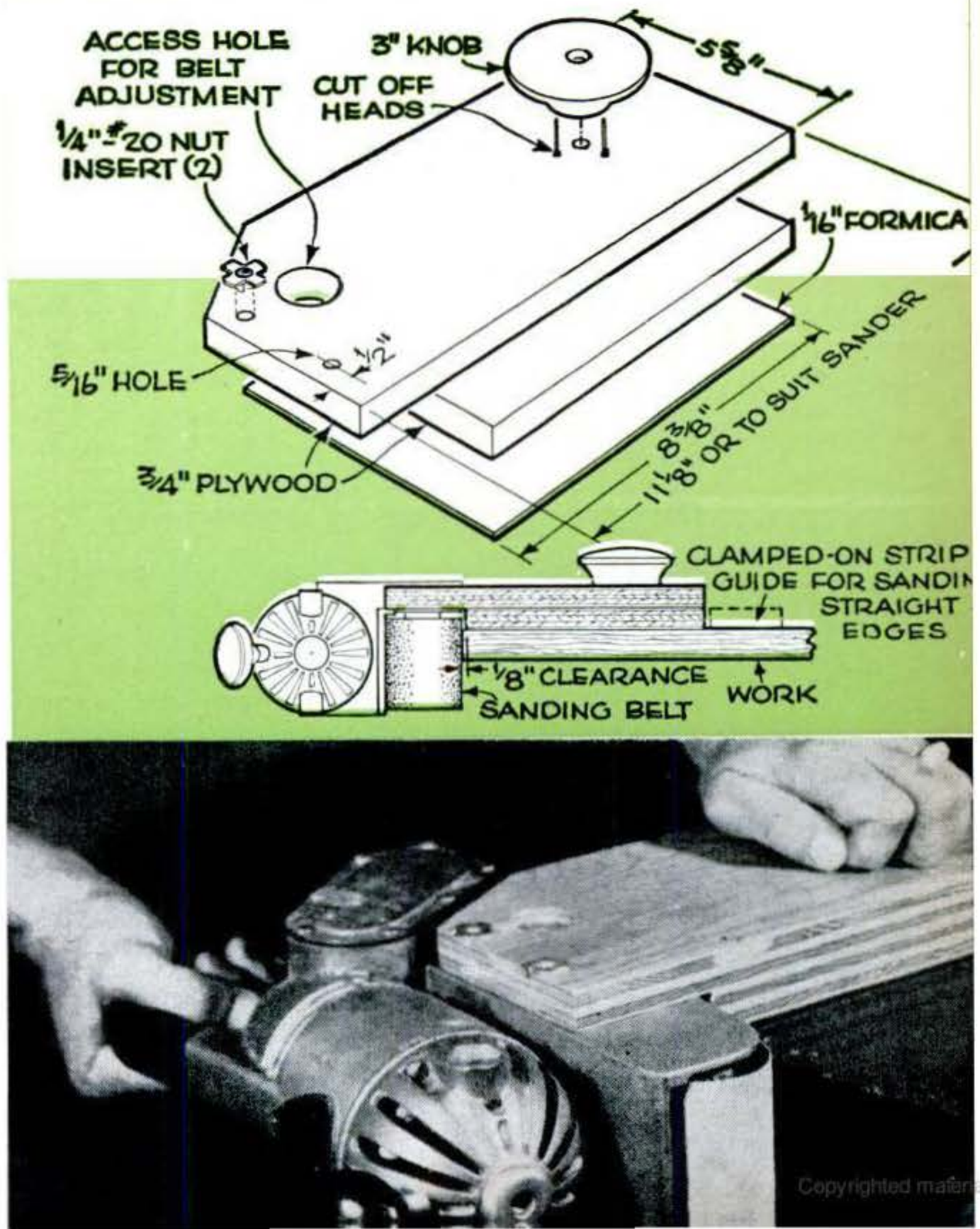
Sanding edges square, whether they're straight or rounded, is a sure thing with this guide mounted on a portable belt sander.

With the belt on the machine, determine where to spot attachment screws. If the machine casting is at least 3/16" thick, holes can be tapped in it or two screws driven through the guide, with washers under them. Drill No. 7 holes and use a ¼"-20 tap.

If the wall is too thin for tapping, drill ¼" holes for screws to be driven from inside the belt bracket into threaded nut inserts.

Cut two pieces of ¾" plywood about the size in the drawing. For the sander shown, a corner was cut off to clear the gear housing, and a hole bored to give access to the belt adjustment knob. Temporarily assemble sander and top plate to determine length of the lower plate, allowing at least ⅛" of clearance between it and the belt.

Cement a thin sheet of Formica to the underside, and sand all edges smooth. Fasten the knob to the top with a countersunk screw, first driving short finishing nails partly into the top of the guide and cutting the heads off. These will keep the knob from loosening. Shellac or varnish the guide.—*Eugene E. Florida, Florissant, Mo.* PS



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Handing the extension light to Buzz, Gus cleaned the rebound-plate seat on the rear-axle housing.

Gus Puts the Pressure on a

Crafty old Silas finds himself out of his league when he tackles a husky football star

If Gus Wilson hadn't been so busy going over his books in the office of the Model Garage, he might have noticed the commotion out in the shop sooner. As it was, by the time he heard the angry voices and got up to look through the office window, all he could see was a cluster of large male forms in a half-circle around somebody who appeared to have his back to the wall. Gus's helper, Stan Hicks, was skittering about, apparently unable to get anyone's attention.

Gus bounded from his chair and pushed his way in between two sets of bulky shoulders. The sight that greeted him was not really funny but it struck Gus that way at the moment. His roar of laughter seemed to break the tension. The circle opened up.

The would-be victim was none other than Silas Barnstable, Gus's most irascible and tight-fisted customer. Silas looked thoroughly frightened. His steel-rimmed glasses were askew, and his eyes darted about like those of a trapped animal.

"Call the police, Gus," he croaked. "I want 'em all put in jail."

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ILLUSTRATION BY RAY QUIGLEY

Tightwad

By MARTIN BUNN

"Hey, wait!" said one of the oversize crew. "Why call the cops? We'll just pick you up and carry you down to the station ourselves." He made a shuffling move toward Silas, who darted away.

As Gus looked around at the ring of faces, he recognized several of the star players on the State University football team. He also decided that they were just frightening Silas and intended no harm.

"Silas," said Gus, "what do you mean by coming into my place of business and starting a fight with these young fellows? Have you been trying to cheat them?"

Barnstable sputtered. "Cheat! Cheat! Gus Wilson, I'll sue you for slander. I sold these—these *characters* a car in a perfectly legitimate business deal so they could tomcat around while they played their games for that university my taxes support. Now they're out to put me on the spot."

One of the big men grinned and thrust out a hand that enveloped Gus's grease-stained fingers like a fielder's glove. "Name's Buzz Cooper, Mr. Wilson," he said. "We'd like to tell you our story. Maybe you can help."

Gus nodded toward the office. "Come on, Buzz—and you, too, Silas. Let's go inside." Silas sidled ahead cautiously.

On the way, Gus noticed for the first time a 1964 sedan with several "State U" stickers on the windows and a flowing puddle of rusty water under the front end.

Inside, Silas sat more or less subdued while Buzz told how he and his teammates had put in long hours of hard work at Silas's place. "We didn't mind the work, Mr. Wilson," said Buzz. "It helped us keep in shape." He gestured towards the car. "And when Mr. Barnstable didn't want to pay in cash, we accepted the car because we needed it to get back and forth between the dorm and the practice field."

Gus nodded. He knew the new practice field was way out on the edge of town.

"But now we're really in a bind," Buzz went on. "We're due to show up for the big game with Bailey Tech by noon tomorrow—the rest of the team's already gone ahead in the bus. We've got a hundred miles to drive and Coach Thomas is going to be mighty sore if we're late. I'm afraid this heap will never make it."

Gus held up a hand. "Whoa—I get the picture. Now let me ask a couple of questions. Did the car run okay when you got it from Silas?"

"Yes, sir, so far as the engine goes, it seemed to. All we did was replace a radiator cap that was sort of crummy and put in a set of plugs. That's when it started to buck and overheat and all the trouble started."

Silas was getting his courage back. "Nonsense, no trouble at all. Just abuse. You young fellows don't have any respect for the value of things."

Gus had known Silas and his short-sighted economics for years. "Let's make it easy, Silas. Start with the ignition sys-

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tem. How did you save money on it?"

Buzz cut in. "We figured he knew something about it, Mr. Wilson. That's why we asked him to meet us at the Model Garage."

"Kidnapped is more like it," snapped Silas.

Gus's voice grew angry. "Come on, Silas, out with it. If I have to spend time hunting out your shenanigans, you'll pay for it."

Silas looked at Gus craftily. "It might be the button . . ."

Gus's eyebrows lifted. "What button?"

"Seems to be a bum condenser. A lot of that going around these days."

"That time you tried to sell me a new distributor rotor just because mine had a little crack, I fixed it with a shirt button. Didn't cost a cent."

Gus looked at Buzz. "And you put in a set of UJ-12Y plugs."

Buzz nodded. "Sure, that's what the chart called for."

"Okay, that answers that one," said Gus. "Silas put a button under the rotor to keep the spark from arcing through the crack to the distributor shaft. He probably closed up the plug gaps, too. The new U-series plugs have a booster gap in the center electrode to improve firing under partial fouling. Normally, it works fine, but the little extra voltage it backs up is causing the spark to jump past the button to ground." He turned to Silas. "You owe these boys a new rotor, Silas."

Silas squirmed. "I won't buy it from you, Gus Wilson."

"Forget it," said Buzz. "We'll buy one. We've got other troubles, Mr. Wilson. The engine overheats and blows water out the overflow."

Silas rose from his chair. "It never did when I had it. I even put in a summer thermostat."

Buzz looked firmly at the old man. "And did you put on the rusty old radiator cap?"

"Yep," said Silas defiantly. "Some smart aleck at a service station hid the cap and tried to sell me a new one. I had this one I was saving out in the barn. It was a good fit."

"I suppose you found the thermostat out in the barn, too," said Gus.

Silas reacted hotly. "Think you're pretty sly, don't you? Well, I did. Never throw 'em away. I had one that just fit fine, even if it was from my old car. It worked, too. I tried it in hot water to see, Mr. Smarty Wilson."

"But it doesn't work with a pressure cap, does it, Buzz?" said Gus. "Silas, I'll make you a bet. If that stat isn't an old bellows type when I take it out, I'll buy a new one and do the job for nothing."

Silas's eyes narrowed. "I'm not a betting man. It worked and that's that."

Buzz Cooper didn't quite see the light. "I can't figure it out. With no real pressure cap, the old stat seemed to work, at least as much as we drove the car. With the new pressure cap, the overheating and overflowing started. I thought the cap was supposed to control that."

Gus opened his desk drawer and took out two thermostats. They both appeared to be about the same size. "Take a look at these," he said, placing them side by side. "One, an old-timer, has a sort of accordion-pleated bellows that expands and contracts to open and close the valve. The other doesn't have anything that you can really see to do the moving, but it has a power capsule filled with a substance that expands and contracts like the bellows."

"Don't make no difference," cackled

Continued

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Silas. "Both'll work. I tried 'em both."

Buzz suddenly caught on. "I get it. The pressure cap traps more pressure in the system than the bellows can overcome to expand. The bellows type was intended for the old low-pressure or no-pressure radiators."

"That's it," said Gus. "The water gets hot and builds pressure, but the stat can't open. Eventually the pressure relieves backwards against the pump and into the bottom of the radiator. Then you get a discharge from the radiator overflow."

Buzz opened and closed his huge hands. "Mr. Barnstable, you'd better come across with a new thermostat."

Silas stared at the enormous hands. "All right," he choked. "But you'll have to put it in yourself. I won't pay outrageous labor charges."

Gus winked at Buzz. "You've got a deal and a witness. Silas buys. We'll put in the stat and flush the system. Now, is there anything else wrong with the car?"

Buzz looked glum. "Yes, there is, Mr. Wilson. I sure appreciate your help on these little things, but we've got a big problem. At anything over 45 the car starts to shake. At 60 it vibrates so bad it scares me. We've had all the tires balanced twice; looked for bent wheels; inspected the engine mounts; checked the drive shaft for damage and bends; even went over the U joints—my uncle told me all this stuff in a letter. He runs a garage back home. I'm afraid we're stuck with a real dog."

Gus got up. "Let's take a look."

"You're not going to stick me with any more tricks, Wilson," said Barnstable. "I'm leaving."

Buzz, chin out, swung around toward Barnstable. Gus shook his head. "Go ahead, Silas, I'll put the thermostat on your bill."

Light where you need it

This little clip-on flashlight, called the Mini-One, turned up at a recent Paris inventors' fair. It doesn't make tire-changing the happy chore this young lady seems to find it, but it might help at that. It's powered by a nickel-cadmium battery that is directly rechargeable from the battery of your car.

With the car over the pit, Gus instructed the other players to get inside the way they usually rode. The car sagged deeply. When he asked them to get out again, it didn't rise very much. Handing the extension light to Buzz, Gus cleaned the surfaces of the drive shaft and the rebounding-plate seat on the rear-axle housing. Working carefully, he placed a bubble protractor on both surfaces in turn. After chalking a few numbers on the side of the pit he turned to Buzz.

"There's your trouble, Buzz. Even unloaded, your angle at the rear-axle U joint is practically zero. Most likely the springs are tired. You should have about two to three degrees' angle."

Gus put the protractor back in its case. "We'll put some wedges between the springs and axle plates. And with all the beef you fellows haul, some booster-type shocks would be a good idea. Anyway, there's nothing seriously wrong."

Buzz gave a sigh of relief. "We couldn't pay you all at once, Mr. Wilson. Maybe I could work it out here at the garage."

Gus laughed. "Nope. I'll tell you what I'm going to do. The car will be ready by five o'clock. You pick it up then. You can get a good night's sleep and start out early in the morning. My charge will be—one touchdown against Bailey Tech tomorrow."

Monday morning, when Gus arrived at the Model Garage, Stan had a big grin on his face. "Gee, that was a great game, wasn't it?" he greeted the boss. "I guess we know who'll be named Player of the Year."

"Who?" said Gus. "Buzz Cooper?"

"No—you," Stan replied. "State won by one touchdown, didn't they? That was *your* touchdown—the one you told the guys would pay for fixing the car." PS

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Shop Talk

By ROBERT P. STEVENSON

Next time you need a mild abrasive, check the kitchen sink

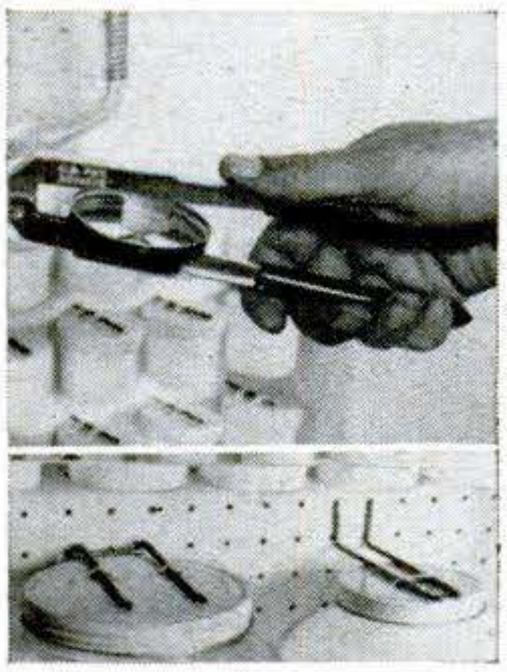
WINTER WORKSHOP IDEA 72

There's one sure way we can tell that an idea's good. A lot of widely separated people make the discovery and write us about it. That's happening now with 3M's Scotch-brite scouring pads. Mildly abrasive, the pads have lots of uses in the shop, too. For instance, Charles Sabon of Brooklyn, N.Y., reports they're dandy for cleaning rust off such tools as scrapers and saws.

Watch for something new—soon—in wall paneling

WINTER WORKSHOP IDEA 73

Architects and interior decorators often specify the use of old, weathered barn boards on the interior walls of homes for a novel and attractive effect. Paneling manufacturers have now taken the cue. At least two are preparing products designed to give the same effect as barn boards. One I've seen lately appears to have remnants of the old red paint still adhering. This one should show up at lumberyards early in the new year.



New way to hang up small-parts storage jars

WINTER WORKSHOP IDEA 74

Many shop owners store small parts in jars, especially baby-food jars, and I've heard of various ways of suspending the jars on a tool board. Now comes a new one. You do it with the two-handled Lid 'L Looper (left). Compressing it punches a jar top to form a loop. Perforated-board hooks or ordinary finishing nails slip through this loop (or loops) to support the jar. The tool costs $2.50 from Dahl Enterprises, Box 708, Hawthorne, Calif. 90250.

How ingenious are you? Do you know of a better trick?

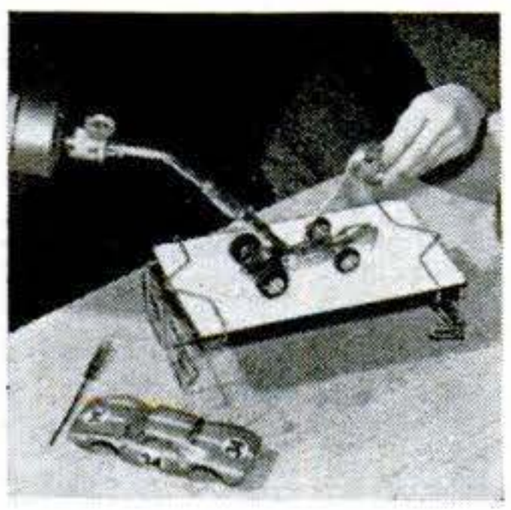
WINTER WORKSHOP IDEA 75

All of us perk up when we hear about a good piece of ingenuity. Joe Buff wrote recently from Far Rockaway, N.Y., about a trick I'd like to pass along. His problem: cleaning up the fine wire scattered around after he used steel wool. Placing a magnet in a wide-mouth jar, he passed the capped jar over the work area. The wire fragments massed against the bottom of the jar. Holding it over his garbage can, he flipped the jar on its side. The magnet fell to the other end and the wires dropped into the can.

Looking for a new hobby—one that might pay money?

WINTER WORKSHOP IDEA 76

Fishing-tackle catalogues aren't normally of much interest to me, but one arrived the other day that you might say hooked me. I found myself fascinated by the materials and equipment for what could be a profitable wintertime hobby—net making. What kind of nets? Fishing nets, naturally, but also camping hammocks, and tennis and baseball nets. You need two special tools—a shuttle and a net gauge. If you'd like to try, ask for catalogue 67C from Netcraft Co., 3101 Sylvania Ave., Toledo, Ohio 43613.



Jet and rocket insulation now hits the home shops

WINTER WORKSHOP IDEA 77

A new Bernz-O-Matic soldering-torch kit comes with an insulated work surface (left) of Kaowool, a ceramic fiber developed by Babcock & Wilcox for jet engines, rocket tanks.

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Would you believe this buffet is a table? It is (photo below), and the blueprint shows how to build it.

Buffet? Dining Table?

here are both in one

It's a real space saver for a small apartment, an extra table for the larger home

By R. E. SCHULTZ

WINTER WORKSHOP IDEA 78

Here's a table that is as much at home in an apartment dinette as in a banquet-size dining room. During the day it is an attractive buffet—but when the dinner bell sounds, it can be telescoped

Continued

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Table can be opened to any desired size to accommodate large or small dinner group. Three inserts on each leaf lock into mating holes drilled in the adjoining leaf to keep leaves in place. This table is built of hardwood for durability, but pine can be used.

out to whatever size table you want.

The table shown is built of hardwood to blend with surrounding furniture; but wood, hardware, and finish can be varied to suit your need. If you use hardwood, some edge-gluing will be necessary because hardwoods are seldom available in widths over 10″. You can have it done at the lumberyard, at nominal cost, if you don't own the equipment to do it.

How to build. Start with edge-gluing. And while the glue is drying you can go to work cutting and shaping the pine framing members for the cabinet. Cut the shelves and back to size, and you're ready for assembly.

Start by joining the shelves and framing; check for square, then attach the back and sides. The shelf support is optional, but it does keep the center shelf from sagging. Attach the stiles and rails to the front and then fasten the top in place. Nails can be used for construction of the frame, but for stronger joinery, screws and dowels were used throughout on this one.

The legs, top, and apron of the movable front assembly should be constructed as shown in the blueprint. If you have varied any of the cabinet dimensions, this unit must be changed accordingly. Leg design is not critical as long as sufficient space is allowed for attaching the apron and slide bars. Remember, too, to provide enough clearance for the doors to open. Note the blind groove on the underside of the movable top; use a router to make it, and, to prevent the cutter from going off, clamp guides on both sides of the router shoe.

Making the slides. The grooves in the slides are made with a dovetail bit in the router. They're easier to do if you cut them to length before grooving.

The slide inserts must be right on the button, so a little practice with scrap is a good idea. For best results leave the line when cutting them, then sand them down so that they slide freely. Temporarily assemble the slide units to determine exact insert location. When you're satisfied, fasten them with glue and a screw through each. Finally, install the screw stop ¾″ from the front edge on each slide as it is added to the assembly. This keeps them from coming apart.

The slide units are attached to the movable front assembly by gluing the first slide of each set to the top, and screwing into the legs. To attach the slide as-

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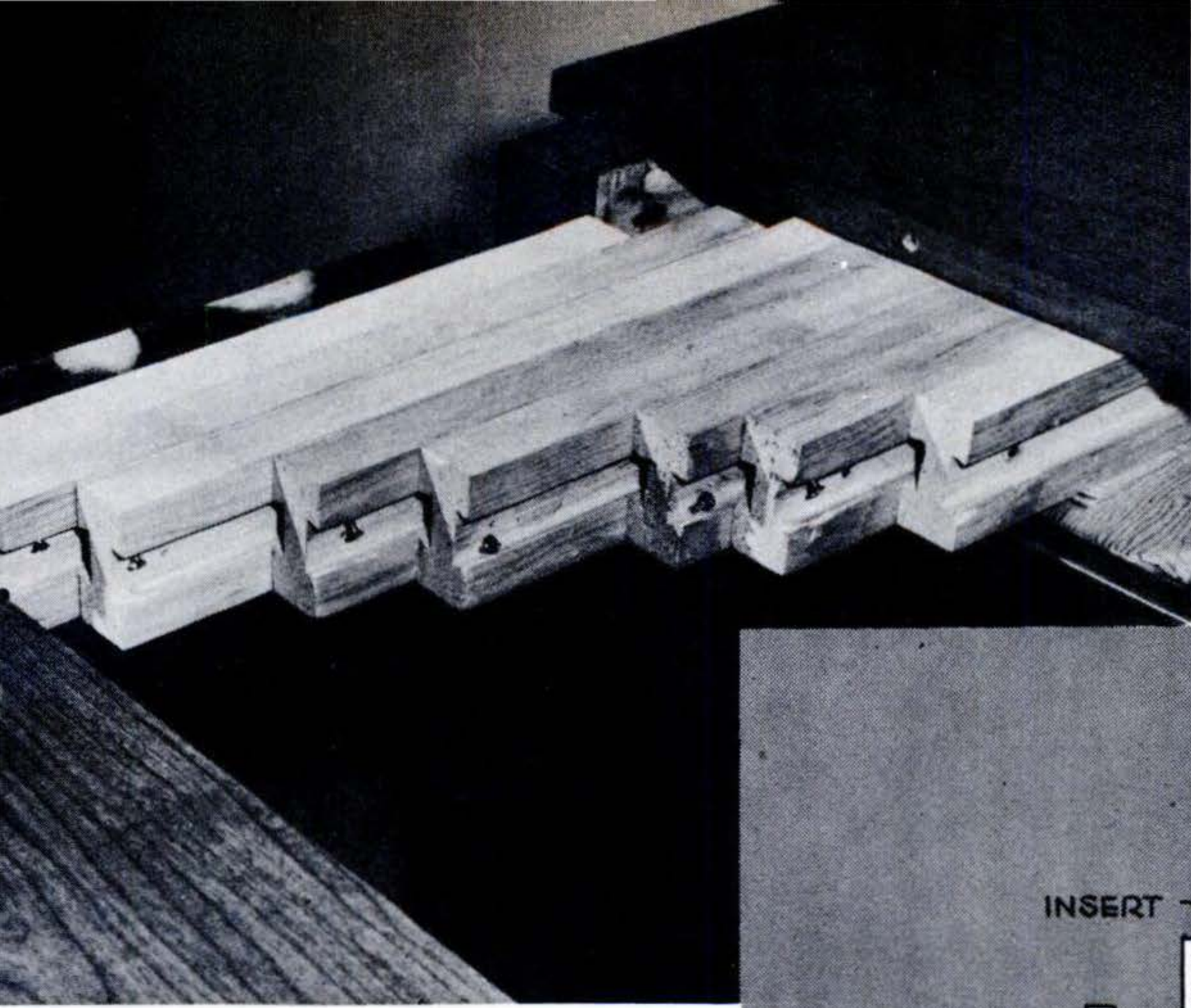
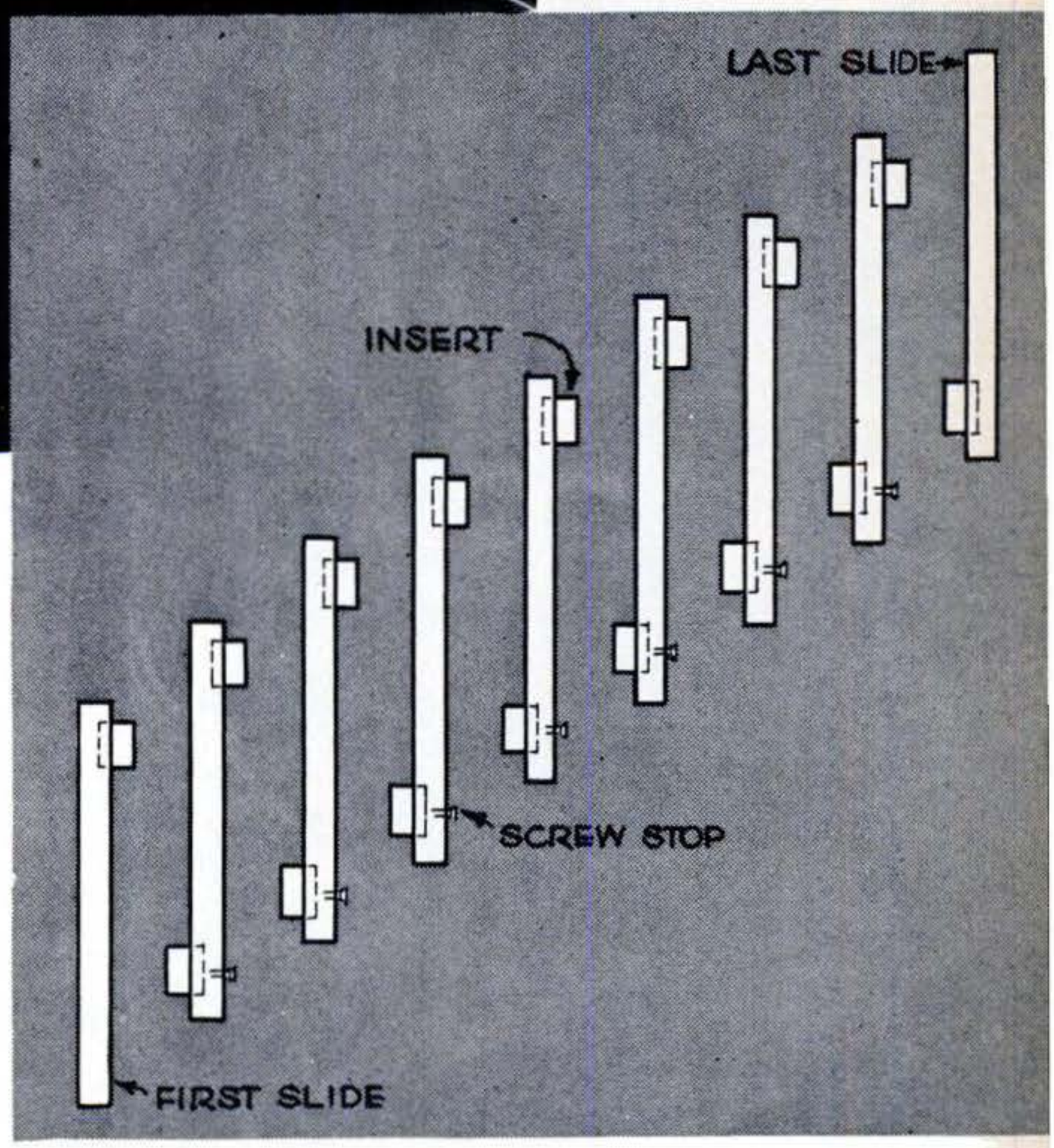


Left-hand group of slides (photo left) are assembled as shown below. As you determine the exact location of each insert, glue it in place. Add the slide to the assembly and install the screw in the groove, which acts as a stop, and keeps the slide assembly from coming apart. Reverse the inserts to assemble the slides on the right-hand side.



Slides are made out of hardwood and left unfinished. A little soap rubbed in the grooves reduces friction and helps the assembly to slide more freely.

sembly to the cabinet, place the slides on the top shelf and line up the front with the cabinet to make sure the top pieces are even. Some adjustment may be required; if necessary, the slides can be shortened to eliminate any gap that might be between tops. When aligned, mark location and install the 1/8″ shim below the last slides. Next, attach the last two slides by screwing through the top shelf into them.

Cut the doors to fit the openings and hang them with semiconcealed hinges. Knobs and drawer pulls are a matter of personal preference and should match room furnishings.

The table leaves. These can be made of hardwood, too, but since they are either stored or covered by a tablecloth, you can save money by using clear pine and staining to match. The leaf inserts can be bought in a hardware store, or you can make your own, using 3/8″ dowels. Cut them 3″ long and glue half the dowel in, then drill 7/16″ holes in the adjoining leaf to receive them.

After a final sanding with 6/0 garnet paper, the table was finished with oil stain and two coats of varnish, left two weeks, and rubbed with paste wax. PS

MATERIALS LIST

SOFTWOOD

49′ pine or fir, 5/4″ x 3″

HARDWOOD

14′ 1″ x 3″
5′ 2″ x 2″
4′ 1″ x 5″
34′ 1″ x 10″
10′ 1″ x 6″

PLYWOOD

1 pc. 1/4″ x 36″ x 48″
1 pc. 1/2″ x 48″ x 48″

MISC.

2 pr. semiconcealed hinges
1 qt. stain, 1 qt. varnish
2 drawer pulls, 2 knobs
screws, glue, dowels

Turn the page for lie-flat blueprint

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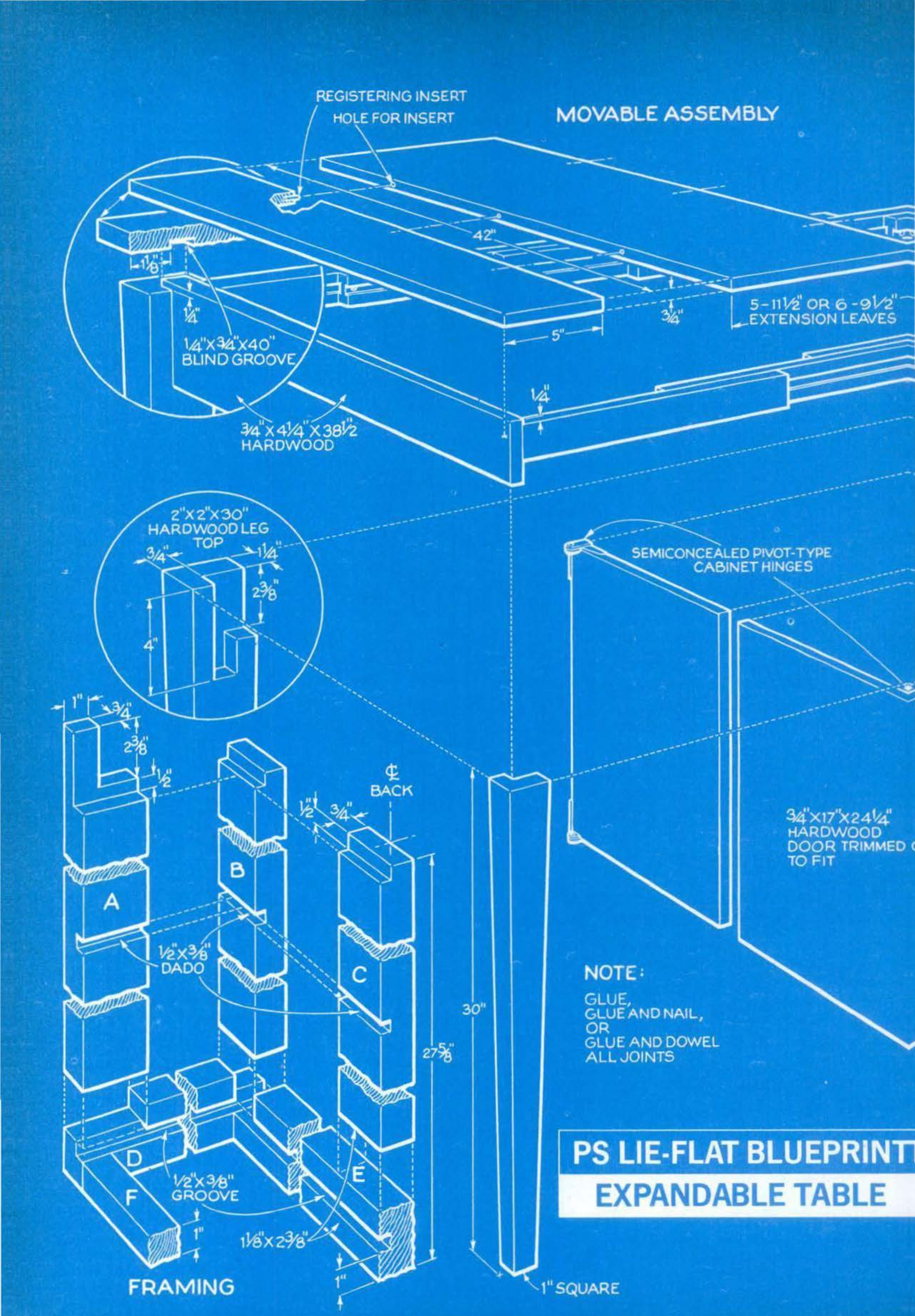
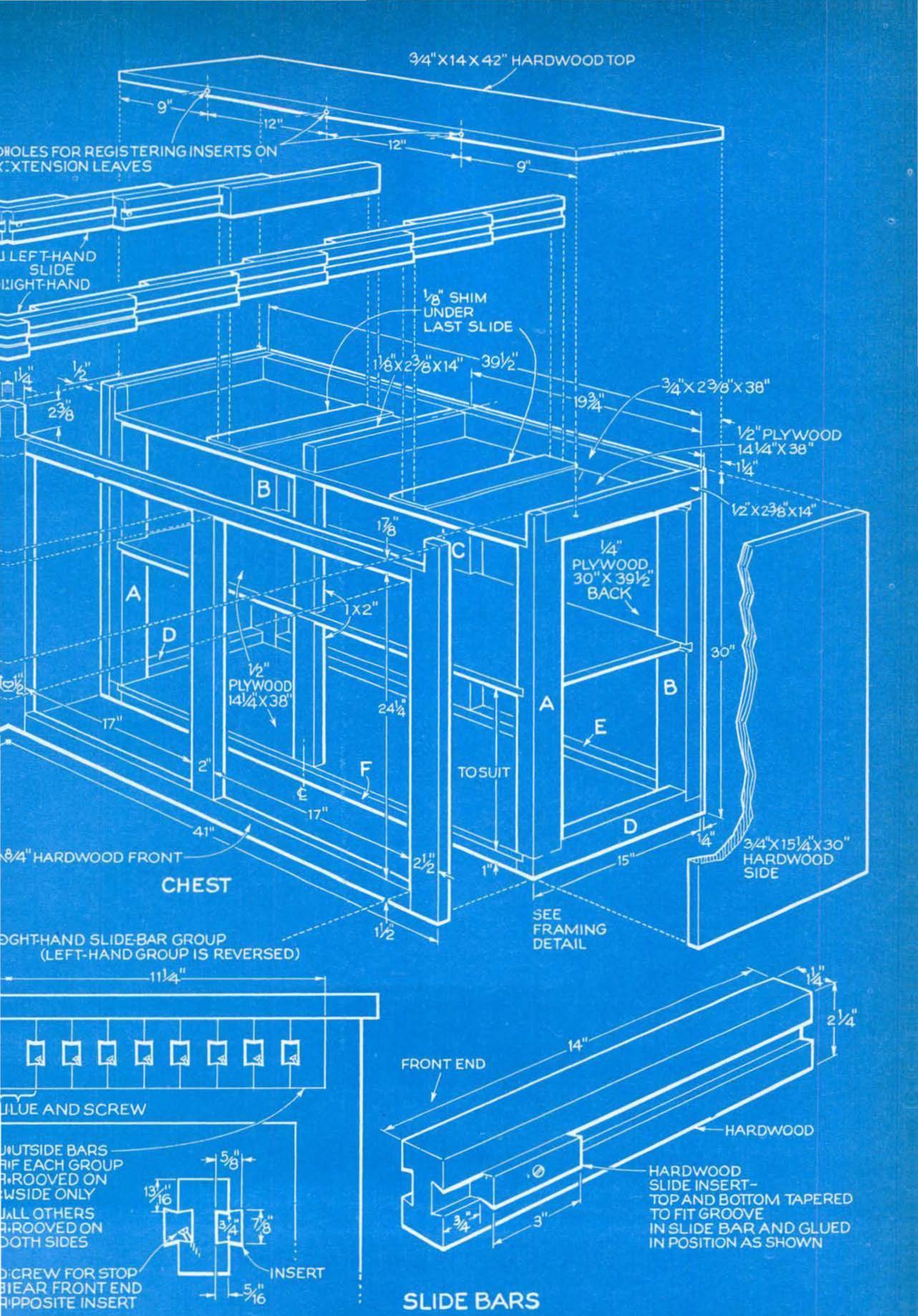
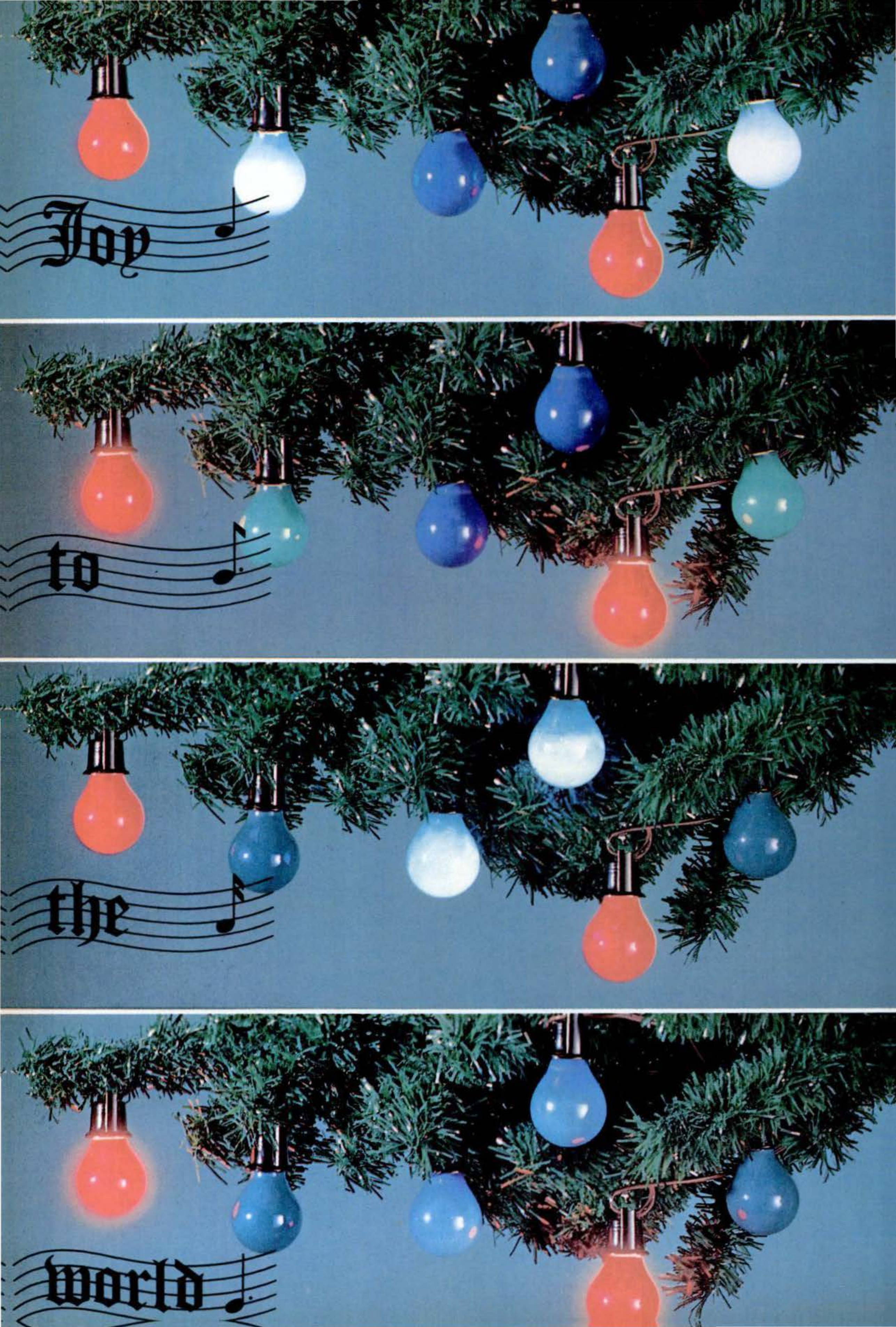

MOVABLE ASSEMBLY
REGISTERING INSERT
HOLE FOR INSERT
42"
1⅛"
¼"
¼"×¾"×40"
BLIND GROOVE
¾"×4¼"×38½
HARDWOOD
5"
¼"
¾"
5-11½" OR 6-9½"
EXTENSION LEAVES
2"×2"×30"
HARDWOOD LEG
TOP
¾"
1¼"
2⅜"
4"
SEMICONCEALED PIVOT-TYPE
CABINET HINGES
1"
¾"
2⅜"
½"
℄
BACK
½"
¾"
A
B
C
½"×⅜"
DADO
30"
27⅝"
¾"×17"×24¼"
HARDWOOD
DOOR TRIMMED
TO FIT
NOTE:
GLUE,
GLUE AND NAIL,
OR
GLUE AND DOWEL
ALL JOINTS
D
E
F
½"×⅜"
GROOVE
1"
1⅛"×2⅜"
1"
FRAMING
1" SQUARE
PS LIE-FLAT BLUEPRINT
EXPANDABLE TABLE


3/4"X14X42" HARDWOOD TOP
9"
12"
12"
9"
HOLES FOR REGISTERING INSERTS ON
EXTENSION LEAVES
LEFT-HAND
SLIDE
RIGHT-HAND
1/8" SHIM
UNDER
LAST SLIDE
1 1/8"X2 3/8"X14"
39 1/2"
3/4"X2 3/8"X38"
19 3/4"
1/2" PLYWOOD
14 1/4"X38"
1 1/4"
1/2"X2 3/8"X14"
1 1/4"
1/2"
2 3/8"
B
1 7/8"
C
A
D
1/4"
PLYWOOD
30"X39 1/2"
BACK
1X2"
1/2"
PLYWOOD
14 1/4"X38"
24 1/4"
30"
B
A
E
17"
2"
F
TO SUIT
℄
17"
41"
D
1/4"
3/4"X15 1/4"X30"
HARDWOOD
SIDE
3/4" HARDWOOD FRONT
2 1/2"
1"
15"
CHEST
SEE
FRAMING
DETAIL
1 1/2"
RIGHT-HAND SLIDE-BAR GROUP
(LEFT-HAND GROUP IS REVERSED)
11 1/4"
GLUE AND SCREW
OUTSIDE BARS
OF EACH GROUP
GROOVED ON
INSIDE ONLY
ALL OTHERS
GROOVED ON
BOTH SIDES
SCREW FOR STOP
NEAR FRONT END
OPPOSITE INSERT
5/8"
13 1/16"
3/4"
7/8"
INSERT
5/16"
1 1/4"
2 1/4"
14"
FRONT END
HARDWOOD
HARDWOOD
SLIDE INSERT-
TOP AND BOTTOM TAPERED
TO FIT GROOVE
IN SLIDE BAR AND GLUED
IN POSITION AS SHOWN
3/4"
3"
SLIDE BARS


Joy
to
the
world

This Christmas, let your tree lights and your hi-fi set work together to make a stunning display

Make Your Christmas-Tree Lights Dance to Music

By RONALD M. BENREY / *PS Electronics Editor*

WINTER WORKSHOP IDEA 79

Colored lights and happy music are traditional at Christmas time. This year, why not team them up to create the most exciting Christmas-tree decorations you've ever seen? The secret is an easy-to-build electronic gadget that literally makes the lights dance in time to music: Connect it to your hi-fi set (or even a table radio), plug-in your tree lights, and watch them glow in perfect synchronism with the music you hear. Soft sounds make the bulbs light dimly; loud tones drive them to full brightness.

Four years ago [PS, Dec. '63], we told you how to build a low-power dancing-lights circuit. The unit described here is far more powerful—it will handle up to 750 watts of tree lights, more than enough to cover the tallest tree you can fit in your living room. What's more, it has three complete channels, each sensitive to a different band of audio frequencies—low, middle, and high. In the setup pictured, we've connected a string of red lights to the low-frequency circuit; green to the mid-frequency circuit; and blue to the high-frequency circuit.

Thus, a musical passage rich in bass notes, like drum beats, makes the red lights glow more brilliantly than the green or blue; middle-octave notes (horn and reed sounds) make the green lights outshine the others; and treble tones (violins, for example) make the blue lights the star performers.

Of course, all three strings of lights burn with equal brilliancy in response to a full-frequency musical passage.

How it works. The three light-controlling circuits are actually triac-type "dimmer" circuits [PS, Nov. '65] with one crucial difference. In conventional light-dimming devices, a potentiometer controls lamp brilliance. You twist the knob to change brilliance. In this device, brightness is controlled by a bank of three cadmium-selenide photocells (PC1, PC2, and PC3 in the diagrams), one for each channel. They act as light-sensitive variable resistors. Their electrical resis-

Continued

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tance depends on the light striking their front surfaces: The greater their surface illumination, the lower their resistance and, consequently, the more current fed to the tree lights by the triacs.

Mounted directly in front of each photocell is a small flashlight bulb (L1, L2, L3) that is connected to a two-transistor audio-amplifier circuit. The brightness of each bulb depends upon the strength of the audio signal fed into its amplifier, but there's a catch: Each amplifier is designed to amplify only a particular band of frequencies—one high, one mid, one low. Thus, L1 lights most brightly when low-frequency signals are fed into the device; L2 when mid-frequency signals arrive; and L3 when low-frequency signals are present. All three bulbs light equally during a full frequency passage.

Transformer T1 is a universal audio-output unit turned around in the circuit and used as an input transformer. It steps up the tiny audio voltages it receives when connected across a loudspeaker (audio system or radio) and feeds the boosted signals to the three amplifier inputs.

Building it. An aluminum minibox is the cabinet/chassis. Mount the three heat sinks for the triacs on a piece of phenolic board (or other insulating material). Bolt the triacs directly to the heat sinks; do not use insulating washers. Because the outer metal case of each triac is one of the device's terminals, it and the metal heat sink are always electrically hot. Therefore, use nonmetallic spacers to support the phenolic board within the minibox, and be sure that nearby non-associated components, hardware, and stray wires can't touch heat sinks or triacs.

Mount the amplifier and power-supply components on the inside surfaces of the minibox, as shown in the diagrams. Use multi-lug terminal strips as mounting and soldering point.

Cement each of the cadmium-selenide photocells (with epoxy cement) to a one-inch angle bracket. Position each cell so that its light-sensitive face "looks through" the screw hole on its bracket.

Before you mount the photocell brackets or the three miniature flashlight-bulb sockets that face them, study the pictorial diagram carefully. Note that the three photocell brackets are positioned in an arc. The bulb sockets are mounted in a straight line, so that the filament in each is directly in front of the appropriate photocell. Each photocell should be able to "see" only one bulb directly.

Cement, with epoxy, the three level-control potentiometers (R7, R8, R9) into position. Before you mount them, hacksaw a thin slit in the end of each unit's shaft. These will allow you to adjust each potentiometer with a thin-blade screwdriver. Be sure to cut access holes in the other half of the minibox.

When you wire the components together, double-check the polarities of the electrolytic capacitors, and of silicon rectifier D1. Diodes D2, D3, and D4, are not polarized devices and can be mounted in either direction. Be careful not to overheat the six transistors when you solder their leads in place. The amplifier circuitry is tightly packed in place

Continued

PARTS LIST

R1, R3, R5—6,800-ohm, ½-watt carbon resistor
R2, R4, R6—3,300-ohm, ½-watt carbon resistor
R7, R8, R9—500-ohm, 2-watt carbon potentiometer
R10, R11, R12—1-ohm, ½-watt carbon resistor
R13, R14, R15—15,000-ohm, ½-watt carbon resistor
C1—10-mfd, 6-volt electrolytic capacitor
C2—0.1-mfd, 100-volt (or greater) paper capacitor
C3—.033-mfd, 100-volt (or greater) paper capacitor
C4—1-mfd, 6-volt electrolytic capacitor
C5—0.5-mfd, 100-volt (or greater) paper capacitor
C6, C7, C8—100-mfd, 6-volt electrolytic capacitor
C9—500-mfd, 25-volt electrolytic capacitor
C10, C11, C12—0.1-mfd, 600-volt paper capacitor
C13—.05-mfd, 600-volt paper capacitor
Q1-through-Q6—GE-type X-9 PNP transistors
Q7, Q8, Q9—GE SC4 triac
D1—1N2070 (or equivalent) silicon rectifier
D2, D3, D4—GE ST-2 Diac diode
PC1, PC2, PC3—Clairex CL603-AL cadmium selenide photocells
T1—Stancor A-7947 output transformer
T2—Stancor P-6465 6.3-volt AC (@ 0.6-amp) filament transformer
PL—6.3-volt pilot light assembly
L1, L2, L3—Type 1850 bulbs in bayonet sockets
SW—SPST toggle switch rated for 10-amp AC service
SO1, SO2, SO3—panel-mount AC receptacle rated for 3-amp (or greater) AC service
Misc: Aluminum minibox, 17"x5"x4"; aluminum heat sinks; phenolic board, 12½"x4"x⅛"; 1" angle brackets; panel-mount fuse holder with 10-amp fuse; terminal strips; insulating spacers; #14 insulated wire; epoxy cement; hardware; wire; grommets.
Note: All of the above components are available from Allied Radio Corp., Chicago, Ill. 60680.

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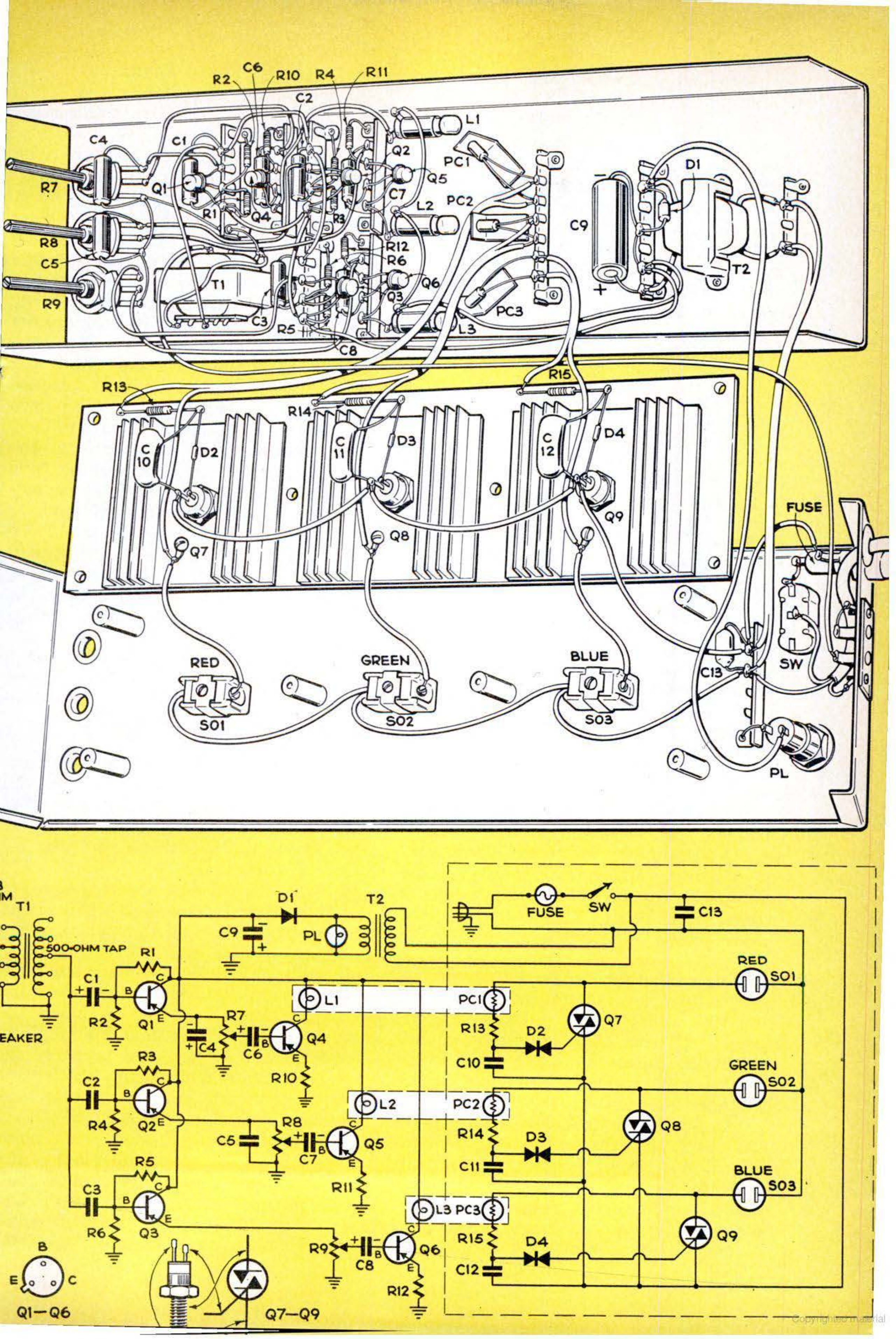
R2
C6
R10
R4
R11
C2
C4
C1
L1
Q2
PC1
Q5
R7
Q1
C7
L2
PC2
R1
Q4
R3
C9
D1
R8
R12
R6
C5
T2
T1
Q6
Q3
R9
PC3
C3
R5
L3
C8
R15
R13
R14
C 10
D2
C 11
D3
C 12
D4
Q9
FUSE
Q8
Q7
RED
GREEN
BLUE
C13
SW
S01
S02
S03
PL
500-OHM TAP
R1
C1
B
C
E
R2
Q1
C4
R7
C6
Q4
L1
PC1
R13
D2
Q7
C10
R10
R3
C2
R4
Q2
L2
PC2
R14
D3
Q8
C11
R8
C5
C7
Q5
R11
R5
C3
R6
Q3
L3 PC3
R15
D4
Q9
C12
R9
C8
Q6
R12
Q1—Q6
Q7—Q9

so watch out for short circuits between adjacent components.

Transformer T1 is a "universal" unit, and has several input and output connections that are accessible at two terminal strips bolted to the unit. Use the connection lugs that are indicated in the diagrams.

Use #14 stranded wire (insulated for at least 300 volts) to make all of the interconnections among components shown within the dotted box on the schematic diagram. Your line cord and toggle switch should be rated for 10-amp AC applications. For safety, the line cord and plug set *must* be a three-wire grounding type. Solder the grounding wire (usually green) to a solder lug bolted securely to the minibox. When you use the completed device, plug it into a three-prong socket, if possible. If not, use a three-prong-to-two-prong adapter equipped with an external grounding lead that can be connected to a suitable ground point.

Using the unit. For maximum visual effect, the three strings of tree lights should each be of a single color, and should each have the same total wattage rating. Note: The circuitry is designed to handle a maximum of 250 watts *per channel,* for a total of 750 watts when all three channels are operating. Never plug any light string rated at more than 250 watts into any one channel.

The device can be connected across the loudspeaker of almost any piece of audio equipment. However, if you connect it to one speaker of a stereo set, the lights will respond to only one channel of sound. You can fix this by flipping the mode switch on your stereo amplifier to monaural—this will place both sound channels on either speaker.

The three level-control potentiometers must be set by trial and error. Experiment until your tree lights glow at full brightness during a loud, full-frequency musical passage, and glow dimly during a quieter selection.

The volume-control setting on the audio amplifier driving the speaker also affects the circuit operation. You will have to readjust the three gain controls for optimum circuit operation whenever you make any change in the volume-control setting. PS

How to Pour a Fireplace

[*Continued from page 134*]

½″ reinforcing rod where the wall around the unit is to go.

2. Move the circulator into place on the slab. Set it in thin cement mortar.

3. With scraps of brick, stone, sheet metal, or asbestos board, build a duct from each of the air intakes to where you will place a grille. These passageways can be crude since they will be buried in the concrete you are about to pour.

4. Build a form all the way around the unit, at least 8″ from it at all points. (For form lumber I used two-by-six tongue-and-groove subflooring, fastened with duplex nails for easy tearing-down and salvage of lumber.) Continue form only to top of front opening in unit. Extend the two sides of this opening from the unit to the form boards. Pad the surface of the unit with mineral wool so that no concrete will touch the steel.

5. Pour concrete to the height of your form work. Add reinforcing steel as you go, and place flat-faced rocks against the forms where they will be exposed when the forms are pulled.

6. Continue the form on up in the same way for the second and succeeding pours. Mortar-in small flat rocks to form a series of channels from the warm-air outlets in the unit.

7. Use a trowel to shape the concrete and form a downdraft shelf just behind the top opening in the fireplace unit. Detail sheets that accompany circulator units show position, shape, and size for each particular unit.

8. As you cast concrete at the top of the unit, shape it to support the first of the terra-cotta flues that will line the chimney.

9. With flue-liner sections as the inside form and lumber or plywood as the outside, pour a chimney in much the same way as you have done the fireplace. For good appearance—and probably far more strength than necessary—make walls 8″ thick or more. Reinforce with at least one piece of steel at each corner.

10. Continue the chimney to a point at least 2′ above the highest point of the roof—3′ with a flat or low-pitched roof. Extra height improves draft. Let the last piece of flue liner extend several inches higher than the concrete. PS

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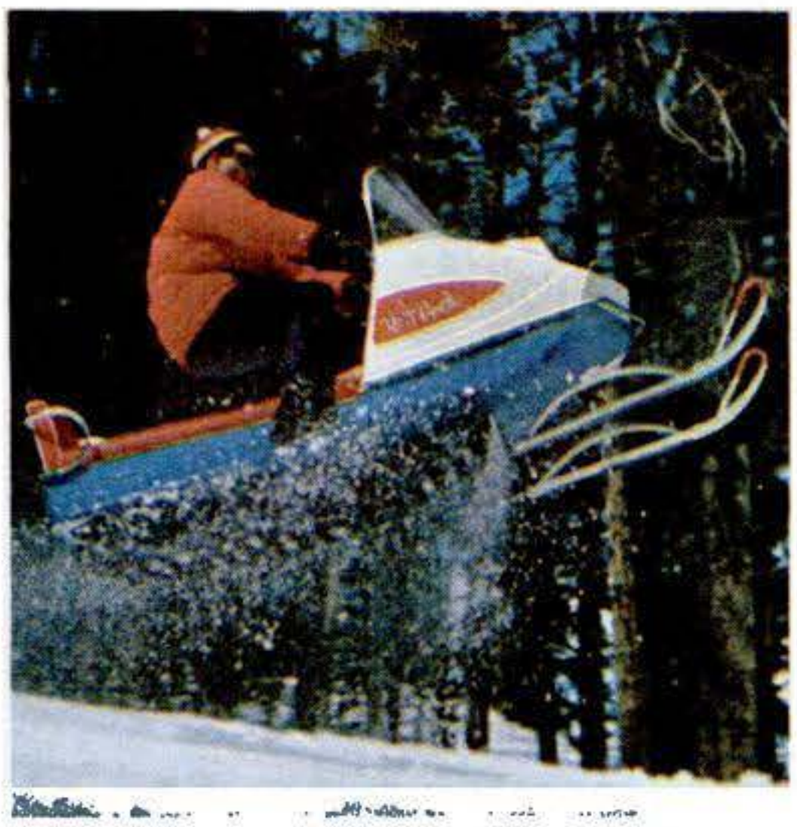

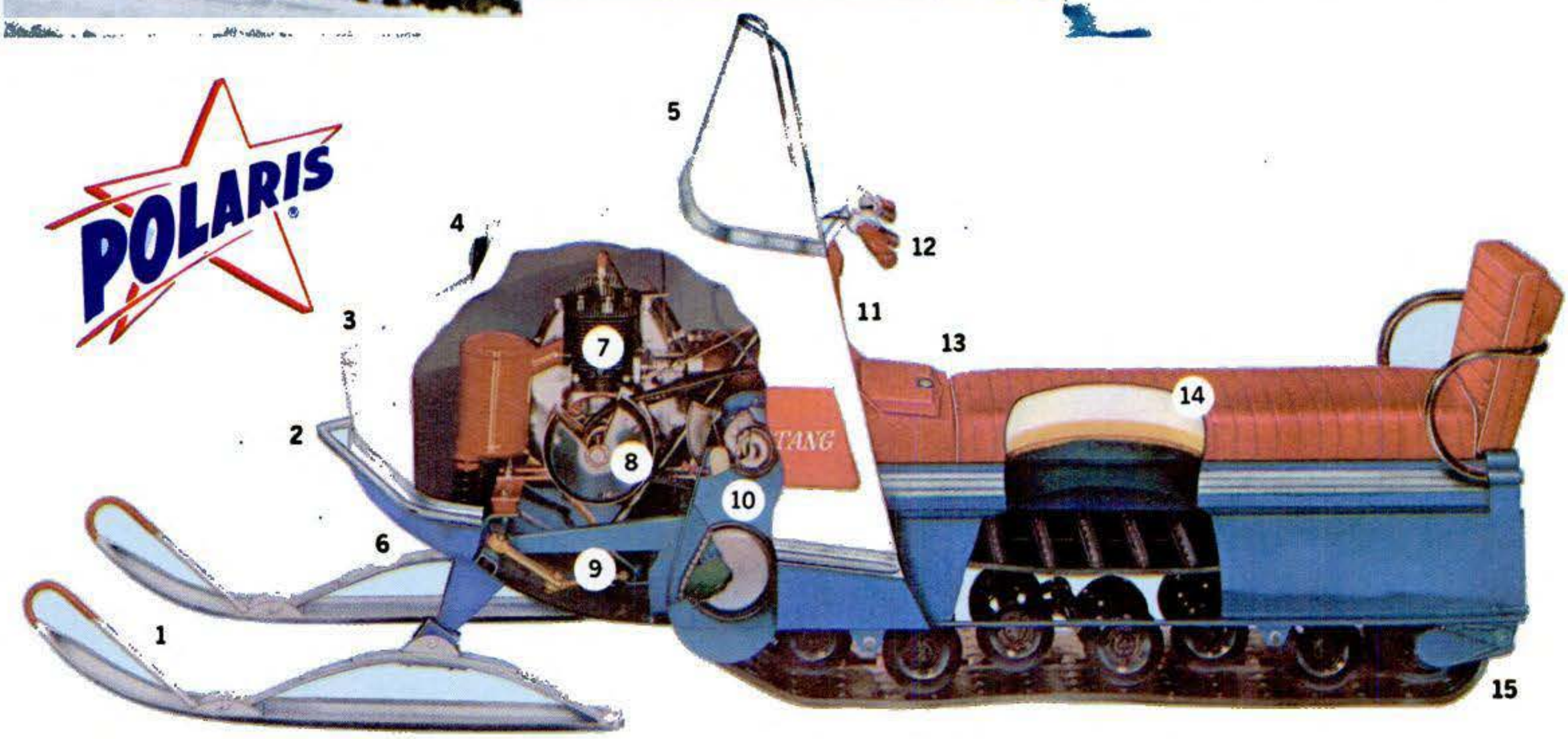

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1. Steering skis designed for free flotation and maximum control over the roughest terrain.
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Canoe Built from Siding

[Continued from page 151]

Making the bottom. The bottom is made from a 4′-by-8′ panel of ¼″ exterior plywood. Cut the panel diagonally and slide the pieces (don't flip either one) until the 4′ edges meet to form a rough diamond. Then set the clapboard assembly on top of the diamond and draw a pencil line around the bottom edge of the clapboards (outside) to outline the hull shape.

Cut the plywood about ¼″ outside the penciled outline. This extra ¼″ should take care of any irregularities you might run into when gluing on the bottom, and can be trimmed off later. The good side of the plywood (assuming you're using the usual A-C grade) should be toward the outside of the hull, that is, facing downward.

If you have a router, make an ⅛″ shiplap joint across the midship joining edges of the pieces of plywood.

Turn the clapboard assembly upside down so the ¾″ bottom edges are up. Lay the already-cut bottom panels in place. Place a pencil mark on the clapboard sides at the point of the midship bottom seam. A 9″-wide strip of ¼″ plywood forms the butt piece. Cut it, and trim it to get a snug fit against the inside of the side planking where it will be centered on the midship bottom seam. The butt piece runs across the hull at an angle that matches the seam between the two plywood bottom sections. Glue the butt strip to the under edge of the midship frame, and to the inside of the planking. Copper-nail it to the frame.

Attaching the bottom panels. Glue-coat all mating surfaces between plywood bottom and clapboard planking edges. Also glue-coat meeting surfaces of plywood bottom and butt piece. This is best done by attaching one bottom section at a time, arranging the shiplap joint so that the second section can be laid on top of the first at the joining seam. Use copper nails to fasten the plywood to the side planking, 1″-#6 flathead brass screws to fasten the planking to the butt piece.

The best gauge of good contact between glued surfaces is "squeeze-out." If there's an even squeeze-out of glue all along a seam, the chances are that the joint is well sealed. Where squeeze-out is lacking, drive nails or screws until it appears. Wipe off excess.

Once the bottom is fastened in place, turn the hull over and check the inside. If there's uneven squeeze-out along any inside seam, either between bottom and sides or at the butt piece, use a round-end stick to smooth a bead of glue into starved areas. Usually, you can do it by sliding squeezed-out glue along a seam to make an even bead all the way.

After the glue has set, trim off the excess plywood around the botom with a saber saw. Final smoothing and blending can be done with a disk sander.

The rest of the job is easy. Fit the frames in place and fasten them lightly with copper nails to hold them until the glue sets. All frames are glued to bottom and side planking. The vertical members should be on the side nearest the stem of the horizontal member. This makes it easy to bevel them with a plane.

The vertical frame members stick up above the clapboard sides to take the glued-on rub rail and cap strip that give the hull 11¼″ overall height. This topping combination makes a tough and stiff gunwale without unnecessary weight.

Bow and stern decks are cut from ¼″ plywood and glue-nailed in place and disk-sanded. Deck coamings are glued up from three layers of ¼″ plywood.

If you plan to car-top the canoe for long, rough trips, you can toughen it further with a removable midship thwart. This can also serve as a seat for one-man paddling. Cost of the materials, exclusive of paint and varnish, came to about $27 on the original boat; the finishing materials were about $6.

Decorations are made by sticking on angle-cut pieces of colored electrical tape. Seal the tape with Plex-glaze (made by Plextone Corp. of America, Newark, N.J.)

If you're accustomed to conventional round-bilge canoes, don't be disturbed by the fact that this one is harder to tip over. The flat bottom and hard chines simply make it more stable. But it glides along with almost no paddling effort. Of course, if you're determined to fall in the water, you can still do it. You just have to try harder. PS

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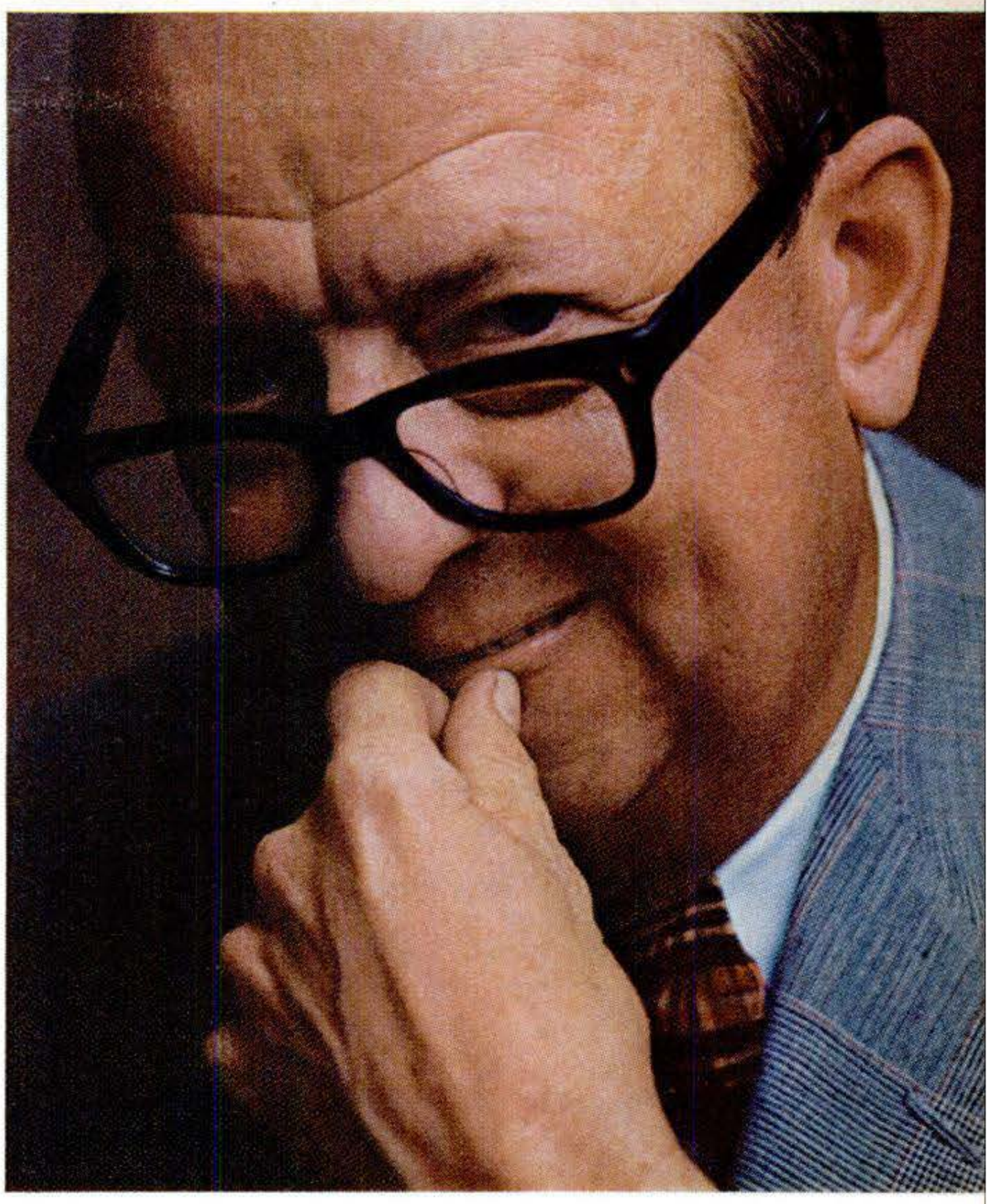
What would you expect to pay for a wall panel with the finish of a $23 wall panel?



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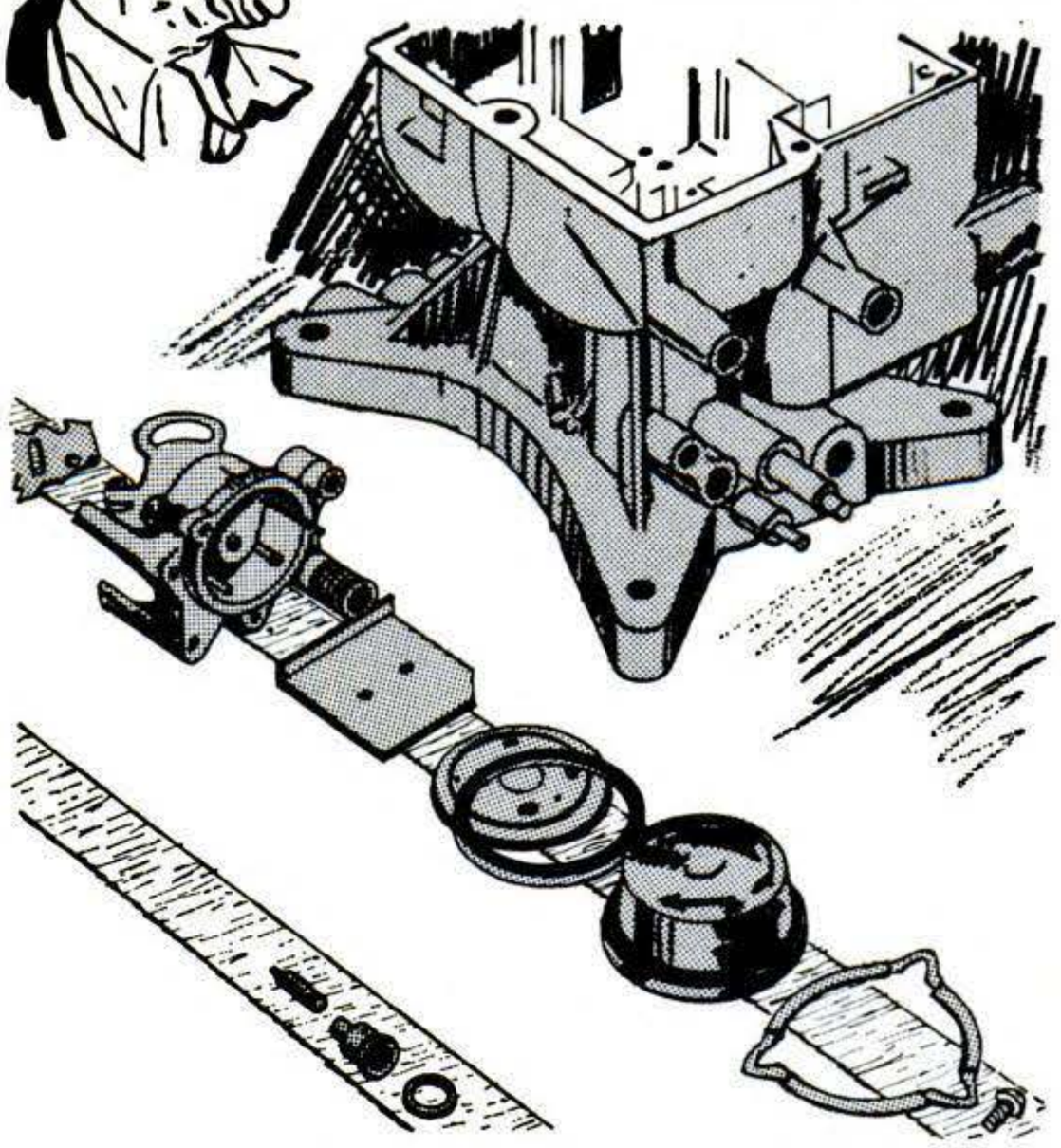
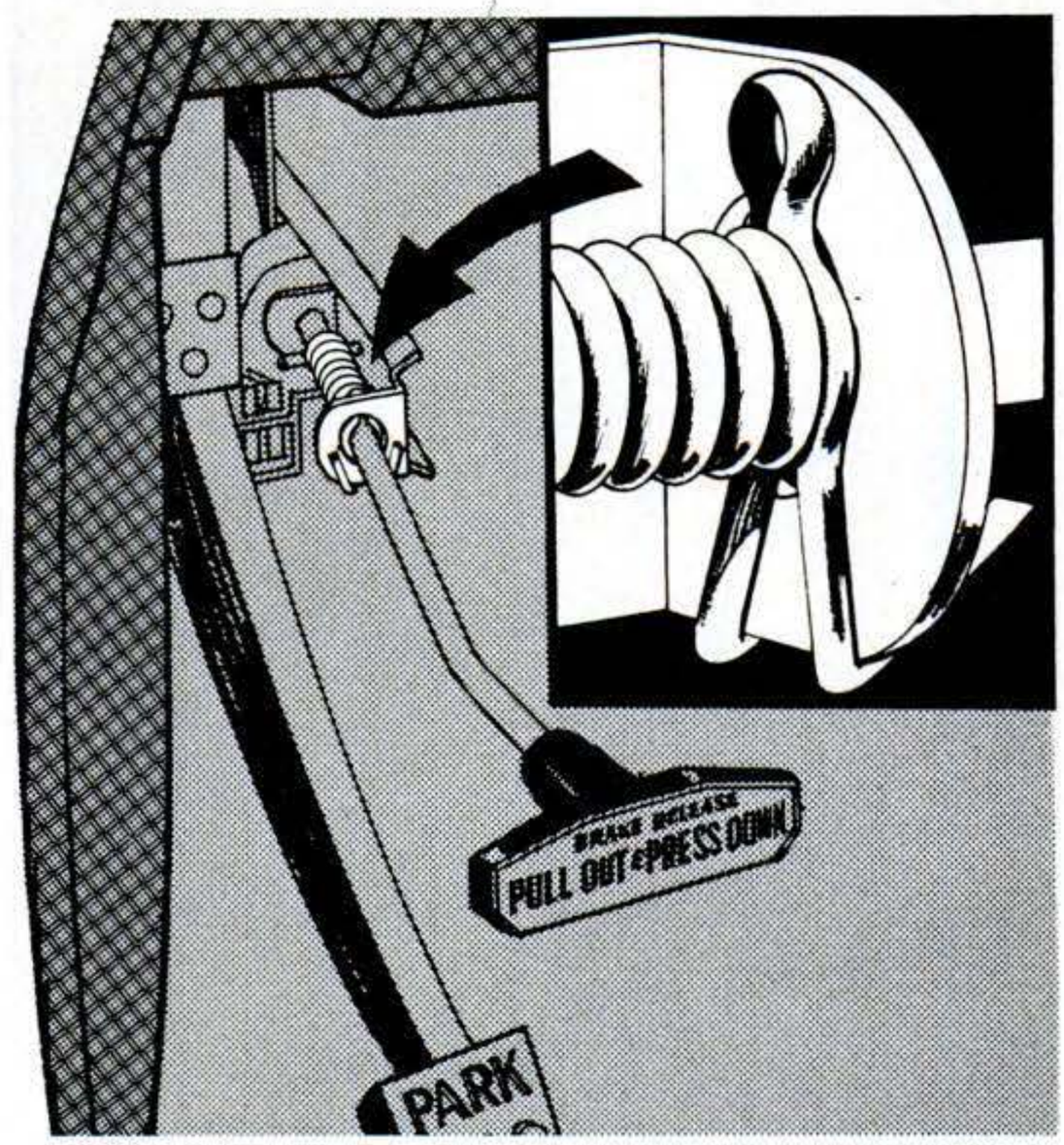
Hints from the Model Garage

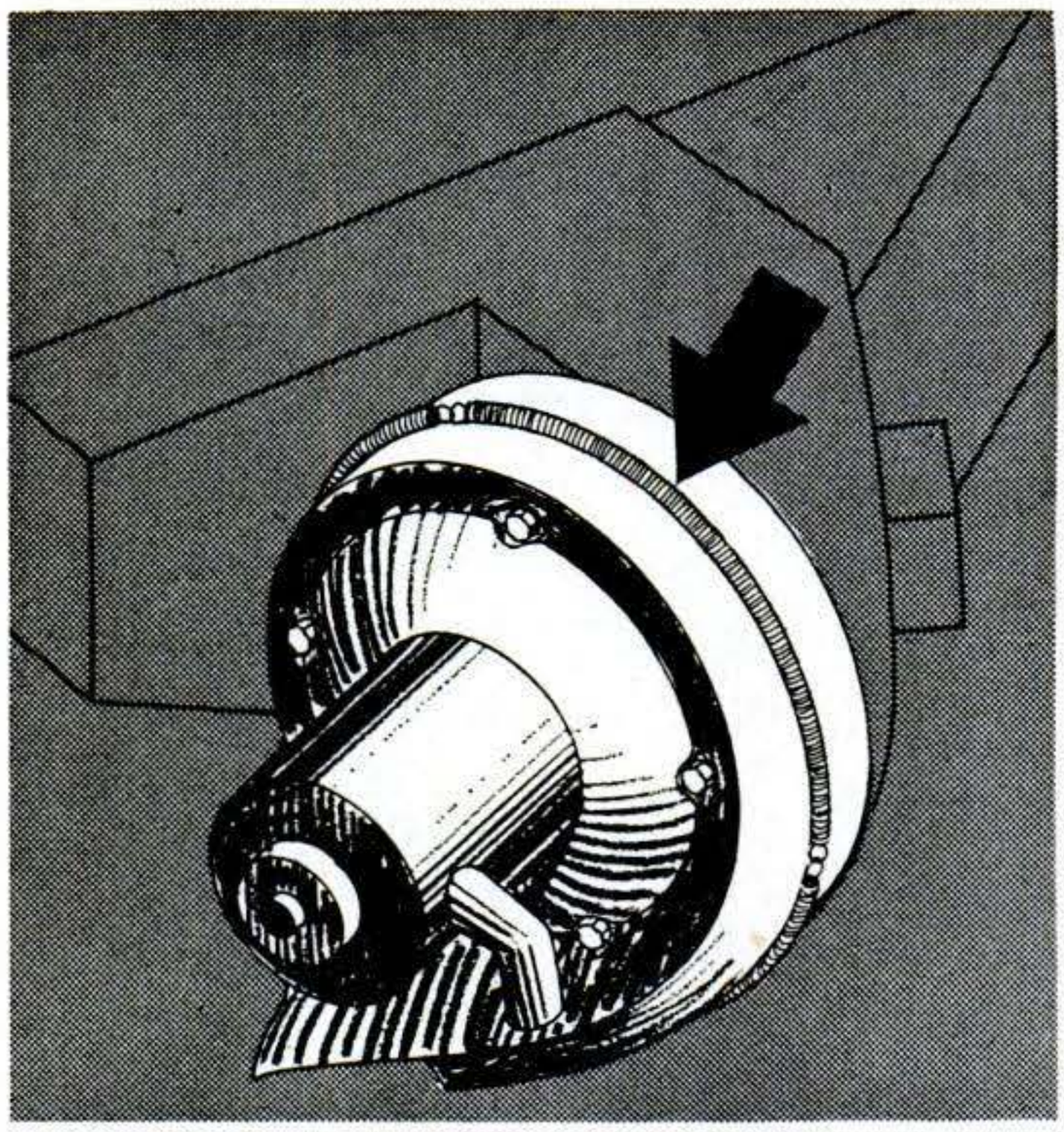
DRAWINGS BY RAY QUIGLEY



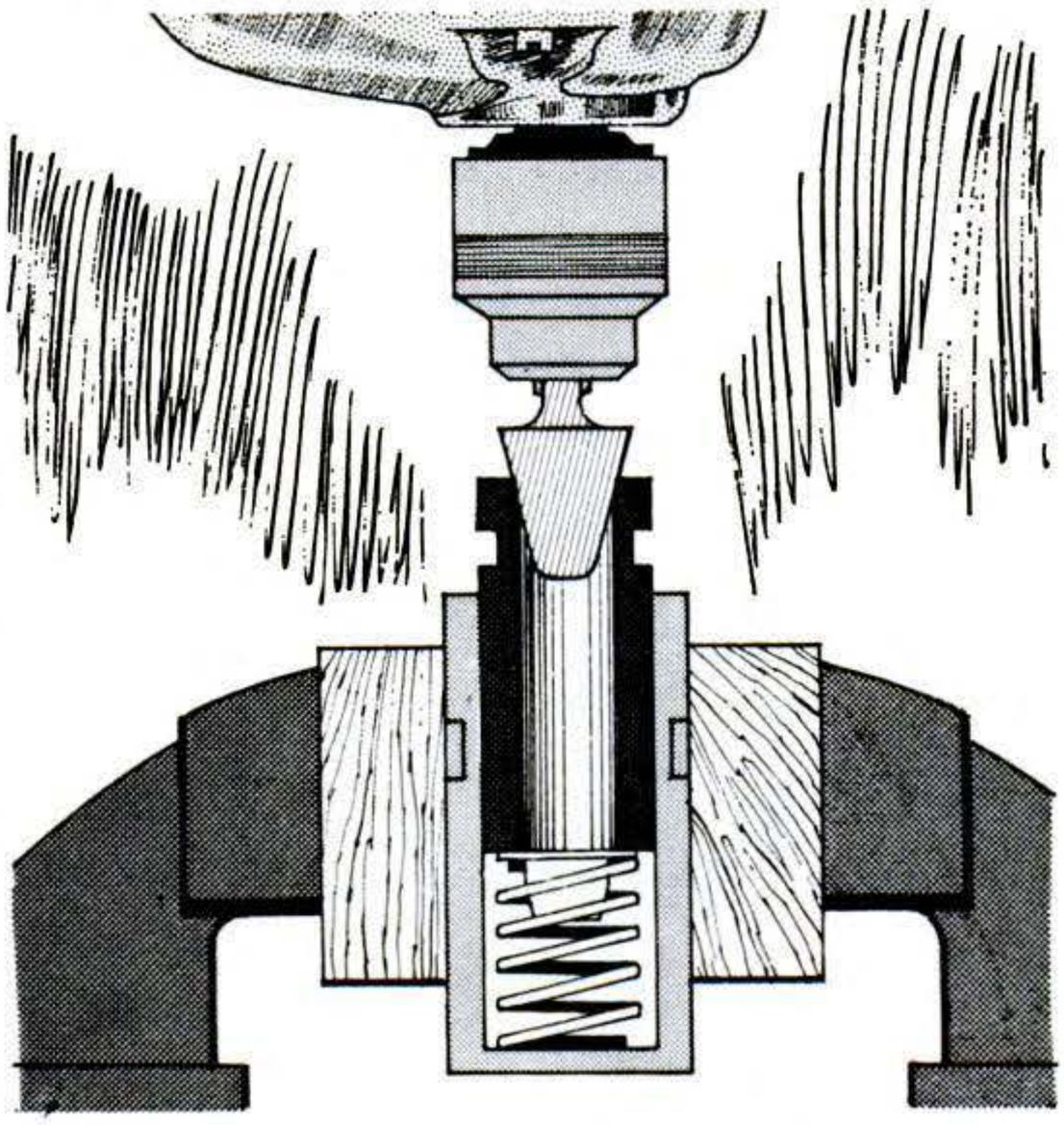
Reassembling a carburetor is a much less awesome task if you dismantle it in an orderly fashion. It saves time, confusion, and errors. The secret: Lay out the parts on a long strip of masking tape in the order of their removal. You'll avoid losing parts, too.



If the parking brake on a Plymouth, Dodge, or Chrysler gives trouble, push the spring back through the hole in the bracket where the plastic bushing has worn out. Slip a cotter pin over the handle shaft behind the bracket and bend the two ends back.



A roaring noise from the air-conditioner fan in your '64 Chevrolet can be cured this way: Place three conventional door springs, wired together as shown, in the groove on the fan housing. Turn on the conditioner, and you'll find the noise much reduced.



Dismantling a hydraulic valve lifter can be slow when the plunger sticks in the body. Fit a wood plug in the chuck of an electric drill, and insert it in the lifter (mounted in a vise). Press down and start the drill and the rotation will loosen the plunger.

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[Continued from page 78]

germs sticking to teeth. You chew it up and swallow it. Then, able to see where the bugs are, you can learn to brush so you dislodge them. Once you've learned, you don't need wafers any more except as an occasional check. Many dentists now demonstrate and distribute the wafers to their patients.

Should you use an electric toothbrush? Some dentists believe an electric is superior; others think it's inherently no better than a manual. A good test might be to see, with the aid of disclosing wafers, which leaves your teeth most free of bacterial clumps.

In addition to brushing, use of dental floss is important. After brushing and flossing, an irrigating spray—the kind you attach to a bathroom faucet—is a help since it can shoot a cleansing stream of water between teeth and between gums and teeth.

Thus, today, with available techniques, it has become possible to make a deep dent in dental disease—to greatly reduce both decay and gum troubles. And many dentists now are beginning to work hard to educate patients in using the techniques.

Look what's coming. A vast amount of research is under way, toward finding other effective measures against dental disease.

Agents active against tooth decay may soon go into foods. Recently, Dr. George K. Stookey and associates at Indiana University reported studies with 500 children who ate breakfast cereals fortified with a chemical, sodium dihydrogen phosphate. In a two-year period, the youngsters had 20 to 40 percent fewer cavities than a control group eating untreated cereals.

Putting phosphate into chewing gum may be a help. Dr. Sidney B. Finn of the University of Alabama not long ago reported trials with 600 subjects, of whom some chewed ordinary gum, some sugarless, some gum with phosphate. After 30 months the phosphate group had 62 percent fewer cavities than the sugar group, 25 to 44 percent fewer than the sugarless gum chewers.

The search is on, too, to find substances that can be ground up into snack foods and fight decay. A National Institute of Dental Research study shows that when shells from peanuts and pecans or hulls from rice and oat kernels are fed to rats for short periods early in life, the animals get long-lasting protection against decay. The shells and hulls contain something that seems to suppress bacteria needed for decay. Now the effort is to isolate the factor or factors.

Scientists at the Institute are also studying the possible value of applying fluoride to the gums. Animal studies have indicated that the chemical makes tooth-supporting bone more resistant to destruction associated with advanced stages of gum disease.

Sealing out decay. In experimental work, dental researchers in Rochester, N.Y., have found that coating the biting surfaces of teeth with a plastic adhesive twice a year produces an 86-percent reduction in decay. They worked with 301 children, five to 17 years old.

Currently, in at least 10 laboratories in the U.S. and Sweden, scientists are trying to develop a vaccine to immunize against decay-causing bacteria. It's not immediately around the corner, but some encouraging results have been reported recently from Notre Dame University, where rats have been immunized against one type of cavity-causing organism.

And right now, too, Dr. Irving Glickman of Tufts University reports, many companies are racing to develop compounds that could prevent plaque formation, destroy it after formation, or prevent it from sticking to teeth. Such compounds—in mouthwash or other form—may be on the market within two years, according to Dr. Glickman.

It seems almost certain that out of all the hot research now under way will come effective new preventive techniques for the future. But those already available—fluoride applications in the dental office and better everyday home-care procedures—can do much to put a damper on dental disease right now. They stack the odds heavily in favor of your having smaller dental bills and being able to sink your own good natural teeth into steaks and corn-on-the-cob for the rest of your life. PS

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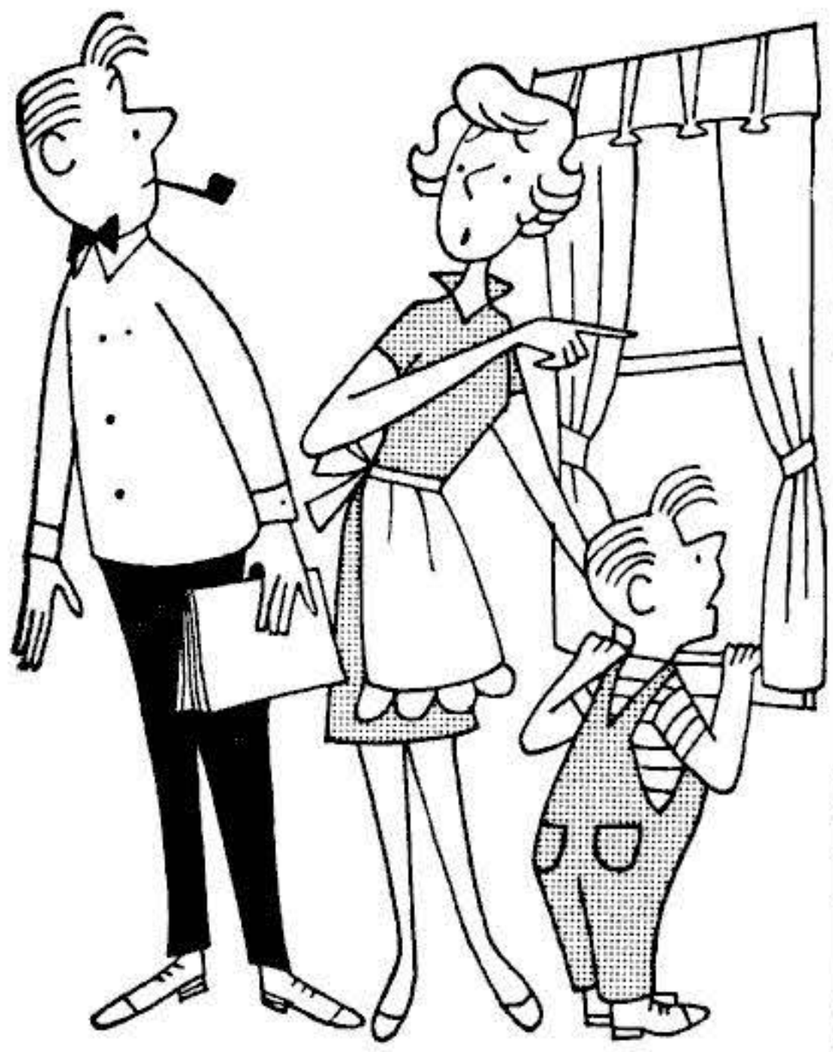
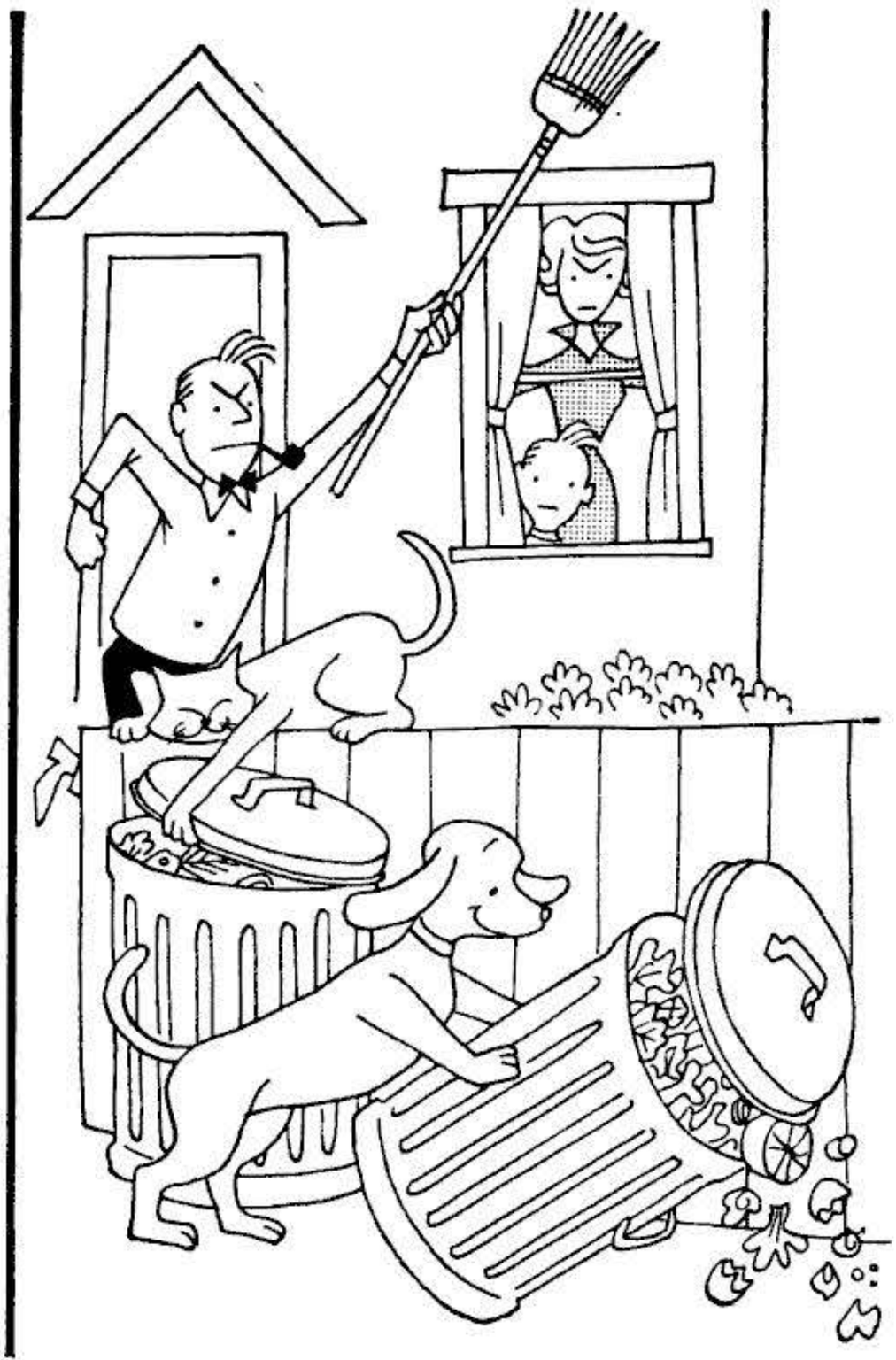
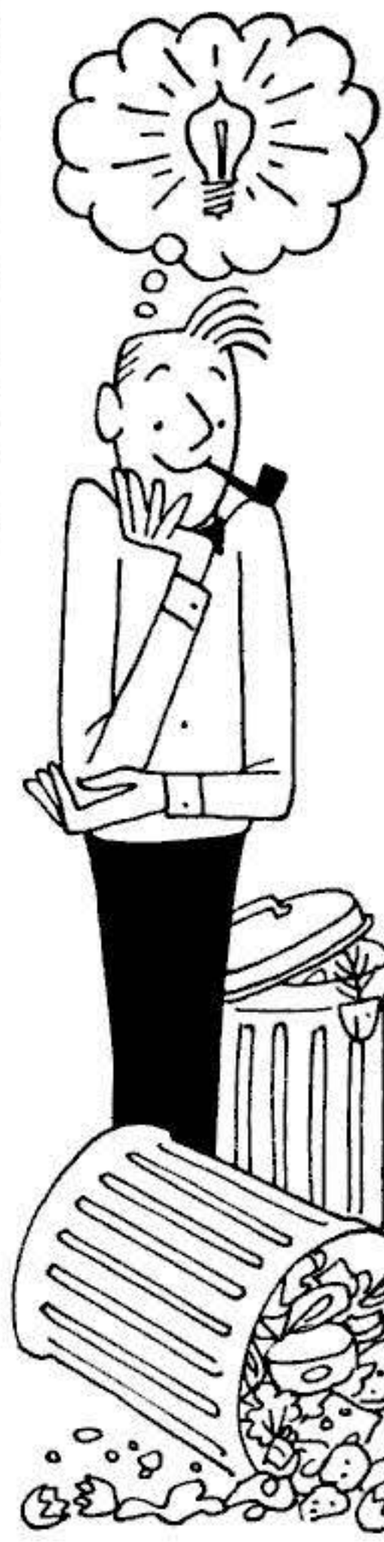
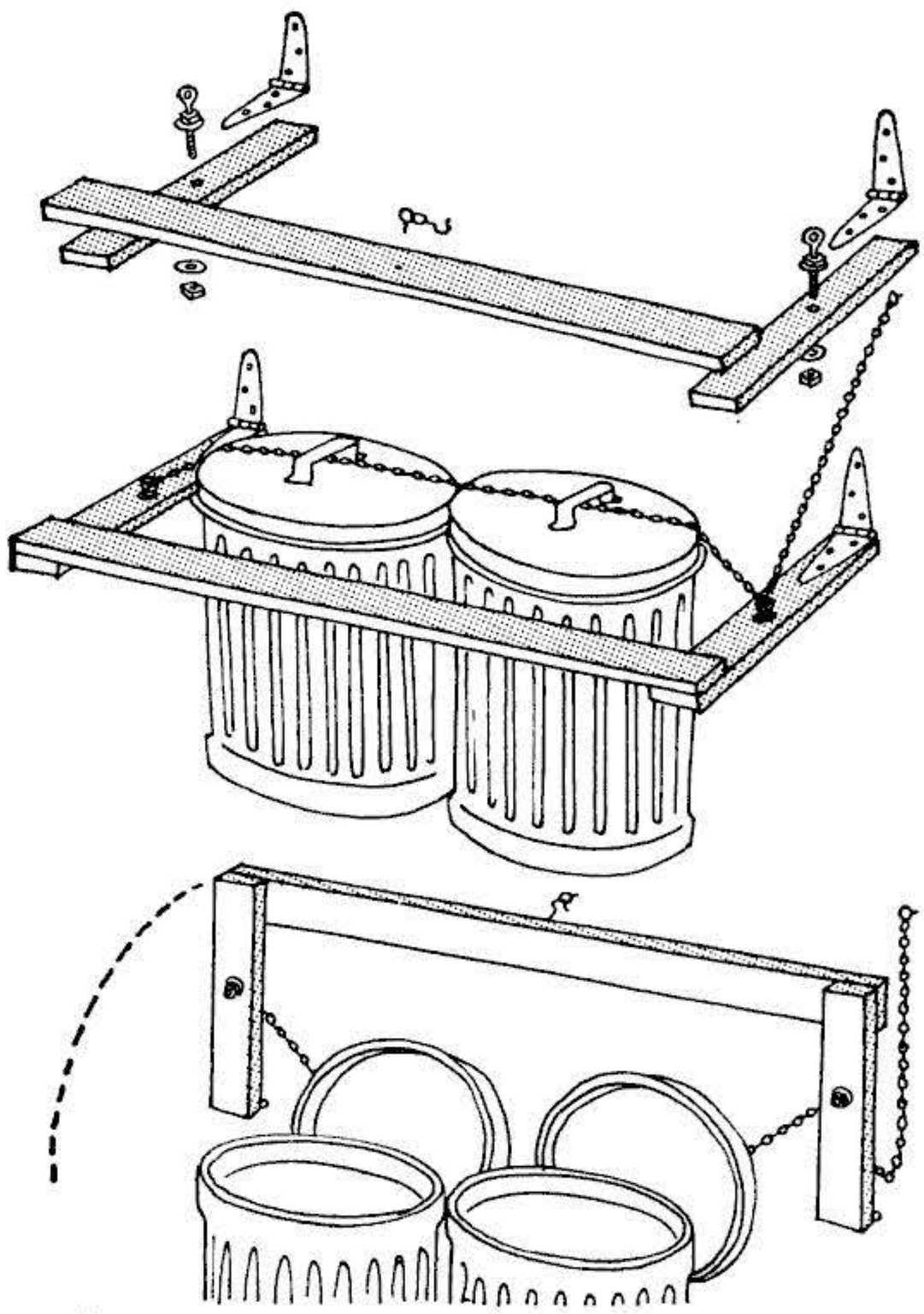
Wordless Workshop

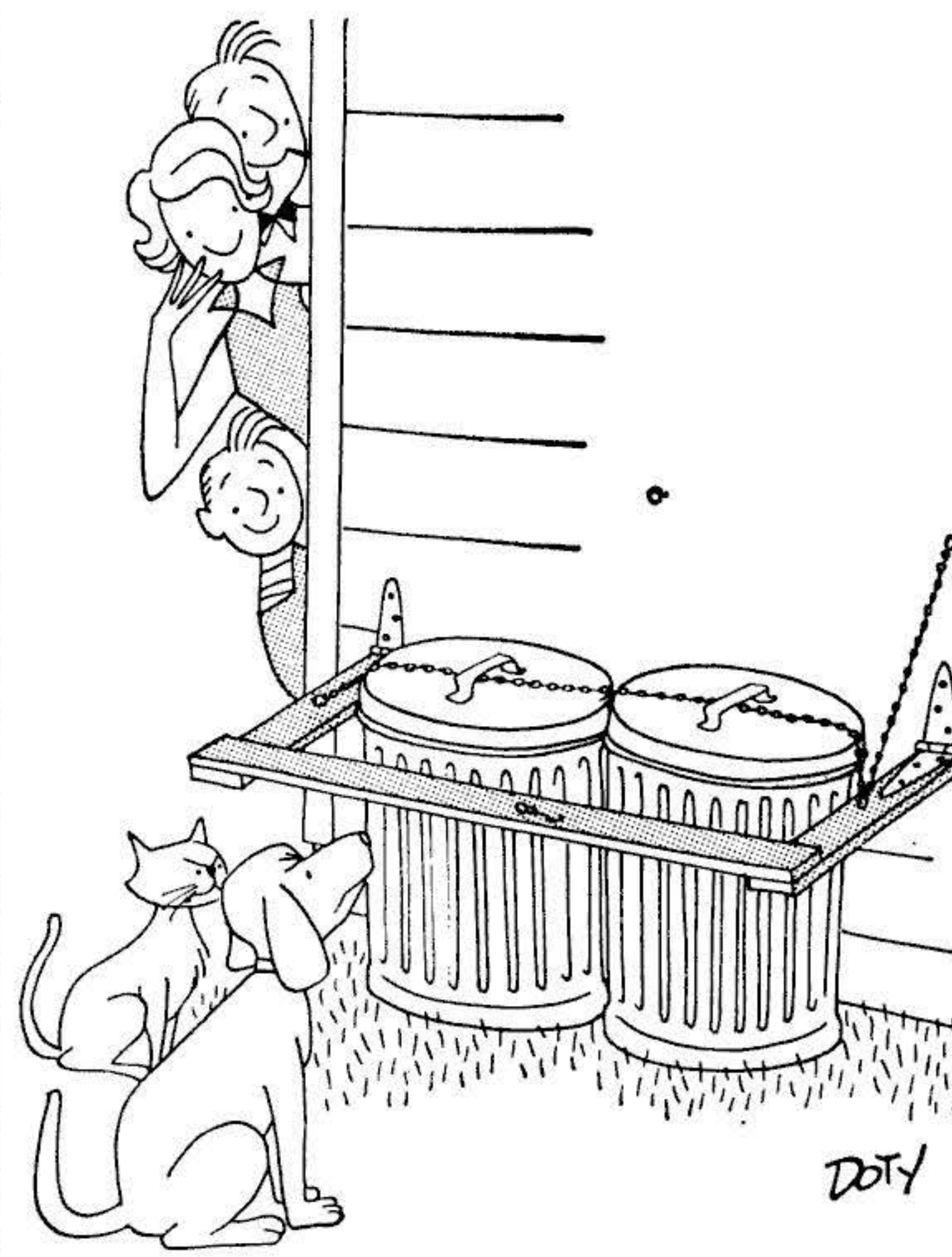
By ROY DOTY











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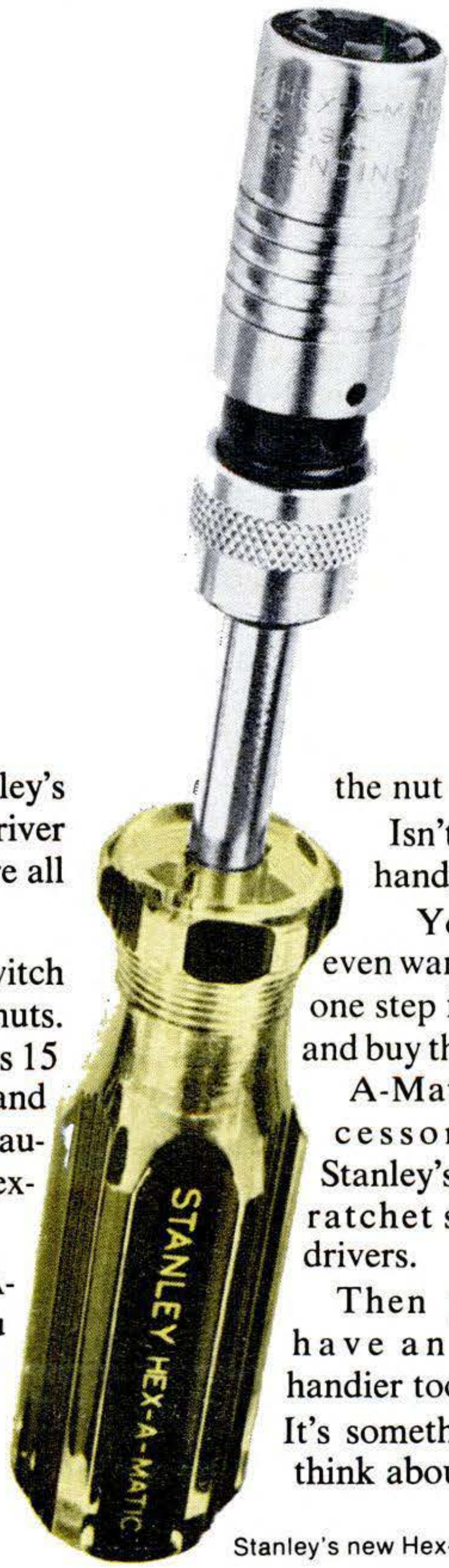
Stanley's new Hex-A-Matic nut driver has 15 heads.

This is them.



The nice thing about Stanley's new Hex-A-Matic™ nut driver is that the attachments are all attached.

You don't have to switch heads for different size nuts. The Hex-A-Matic accepts 15 sizes of nuts and screws, and the switching is all done automatically, inside the Hex-A-Matic head.

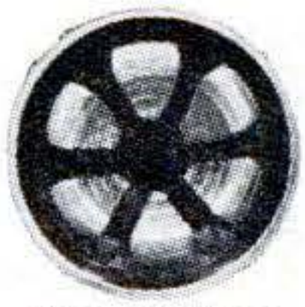
You just put the Hex-A-Matic on a nut. Then you bear down a little, the way you do with a screwdriver. Six steel collet fingers grab the nut and hold fast while you turn the nut driver.

Isn't that a handy tool?

You may even want to go one step further and buy the Hex-A-Matic accessory for Stanley's spiral ratchet screwdrivers.

Then you'll have an even handier tool.

It's something to think about next time the right size wrench or ratchet attachment turns up missing.



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When Stock Cars Don't Finish . . .

[Continued from page 69]

Carburetors don't cause much troubl any more, or plugs either, and belts don' break. Where the family car gets int carburetor trouble is in vapor lock o hot days. In racing, we don't get vapo lock because the huge volume of fue cools things off.

We *are* breaking blocks in the web where they hold the main bearings. Wha happens? When we examine a blown en gine, the damage is so great, we don' know whether a rod cracked or brok first, or a bearing started to let go, or main-bearing web let go.

We used to bust cylinder heads, bu not much any more. We hardly eve blow head gaskets in racing now. W used to break piston rings, too, but the the ring companies came out with th chromed-steel compression ring, and thi trouble disappeared.

After engine and engine-componen trouble, the next big failure area is th rear axle. Axle shafts don't break, an rear-wheel bearings and hubs are no prob lem because they are full-floating, lik the ones on a ¾-ton pickup. All that th bearings do is support the vehicle. I a conventional car, of course, if a ma breaks an axle, his wheel falls off. Tha can't happen in a modified stock racer

Heat at the stern. But trouble does develop in the stern of the racer, an this comes from heat buildup. The dif ferential is the key here. We have t be choosy about the oil we use, and ev erybody uses a cooler.

The axle oil cooler has a pump with fan on it. A regular axle takes about 2½ pints. With the pump's recirculating sys tem, you can boost this to six or seven

Stockers used to burn up front-whee bearings, but hardly ever do now. Front end assemblies for racing are at least 20 percent stronger than standard parts.

We're suddenly getting a lot of whee breakage, though. This is new. What' the problem? Well, at Daytona, for ex ample, where you're running at 18 m.p.h., lateral and centrifugal force o the right front wheel is 2,800 to 2,90 pounds. The wheel has a side force o it of around 1.45 *g*. With such loads try ing to bend the wheel, it breaks.

Exactly the same forces are in pla

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When Stock Cars Don't Finish . . . when you lose a hubcap in a hard turn at speed in your own car.

So the wheels we are running actually are two stock wheels welded into one. They double up their centers.

Transmissions. We still fail transmissions now and then, but that's more of a road-racing problem. There's a whale of a difference between that, with all the clutching and shifting, and circle or oval-track racing.

On some short tracks, you run in second gear of a three-speed, or third gear of a four-speed. The problem, again, is heat. The heat buildup in the transmission oil is tremendous, so we use coolers.

Nobody, by the way, as yet has used an automatic box successfully in stock-car racing.

Clutches don't wear out. Centrifugal force throws the lining off from overwinding. Or pressure plates and flywheels simply explode.

High-speed braking. Braking is getting critical in stock-car racing, for two reasons. The first is that we're at the point where we just can't get any more area for linings and shoes. The second is that the race promoters are adding some very fast mile tracks, and these have turned out to be pure murder on brakes.

Take Rockingham, N.C. Brakes probably are the single biggest failure there. You've got 4,000 pounds of car, and you hit a peak speed of 140 to 145, and you can't get through the corners at more than 85 or 90.

Brake failure at Riverside can mean sudden death. You come to a flat turn and don't make it, and you slam into a steel wall.

The cure is sophisticated and expensive. It's a two-shoe Bendix using a sintered-iron lining. The backing plates, as such, disappear, and you have webs in their place to position the shoes. The shoes are well-trapped, so they can't flex in contracting the drum. Our racing-wheel cylinders carry steel instead of aluminum pistons. We found that the wheel cylinders were getting so hot that the aluminum was sticking in the bores and burning up the rubber cups. Now we have exotic synthetics for the cups, and high-temperature brake fluids that will stand up to 700 degrees. *Continued*

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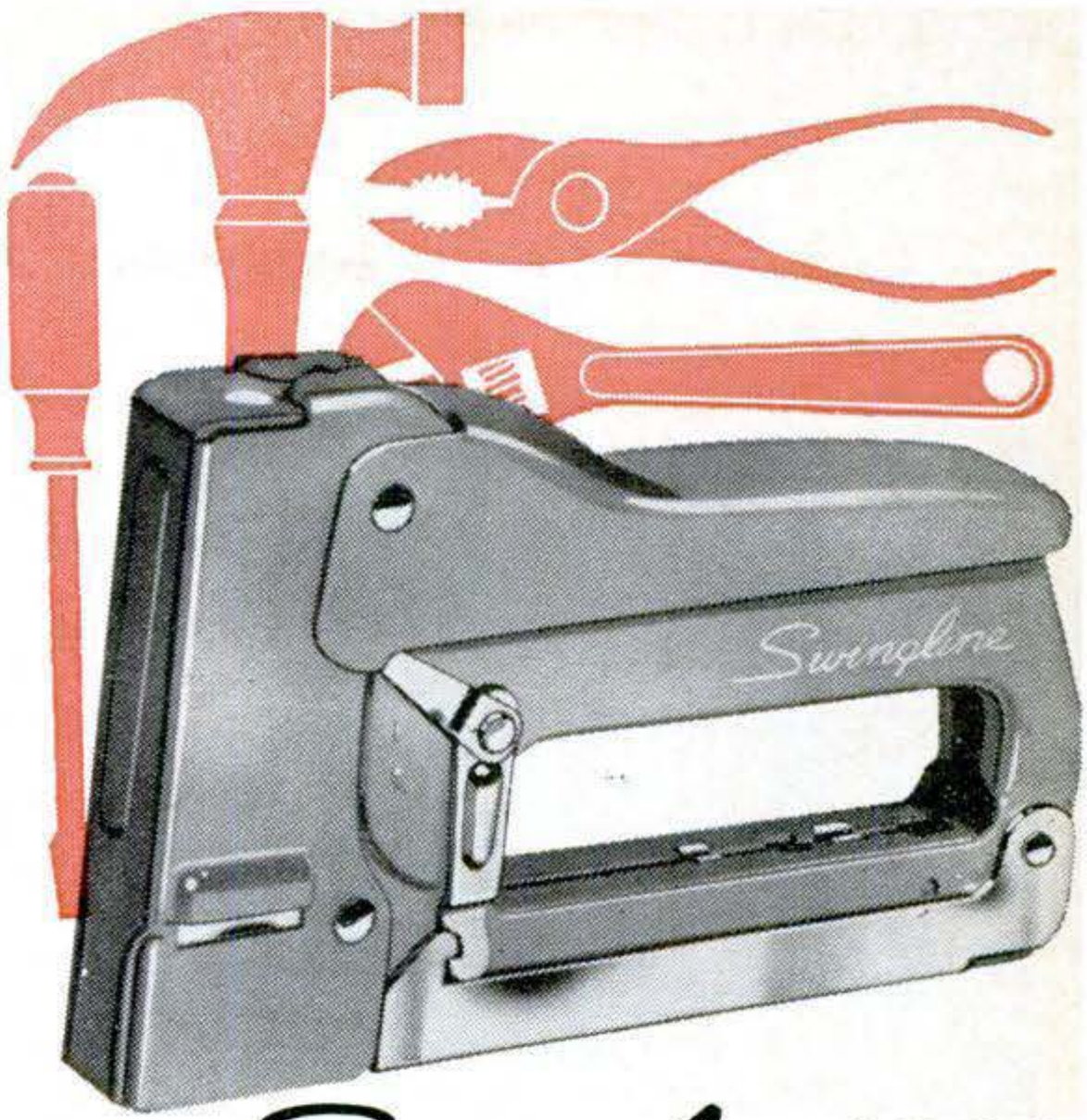

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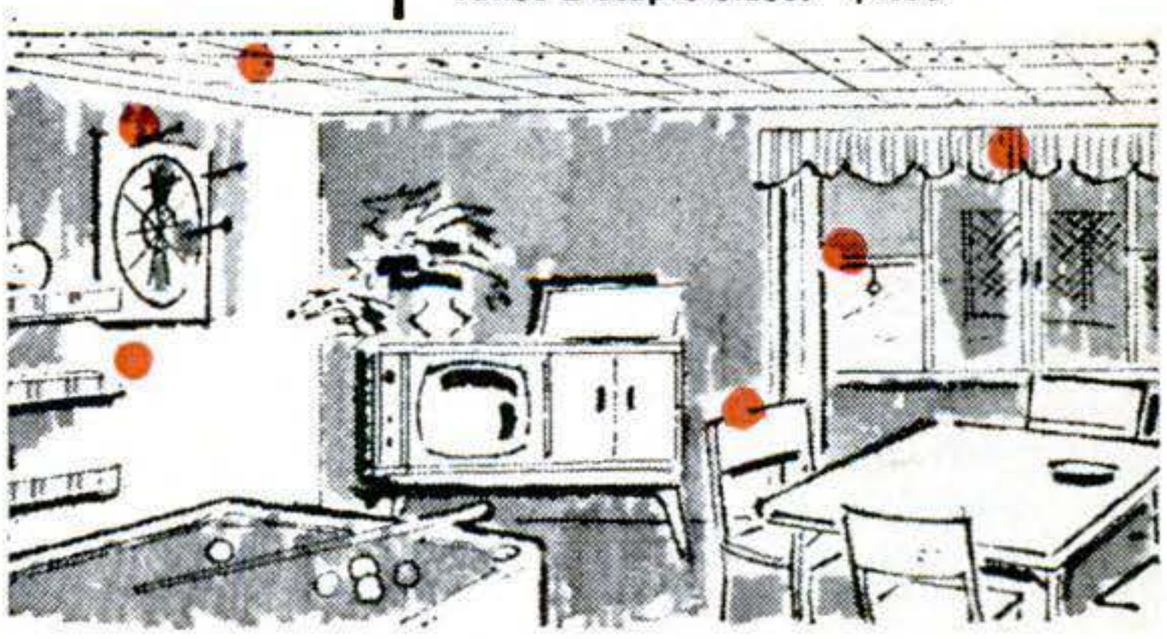

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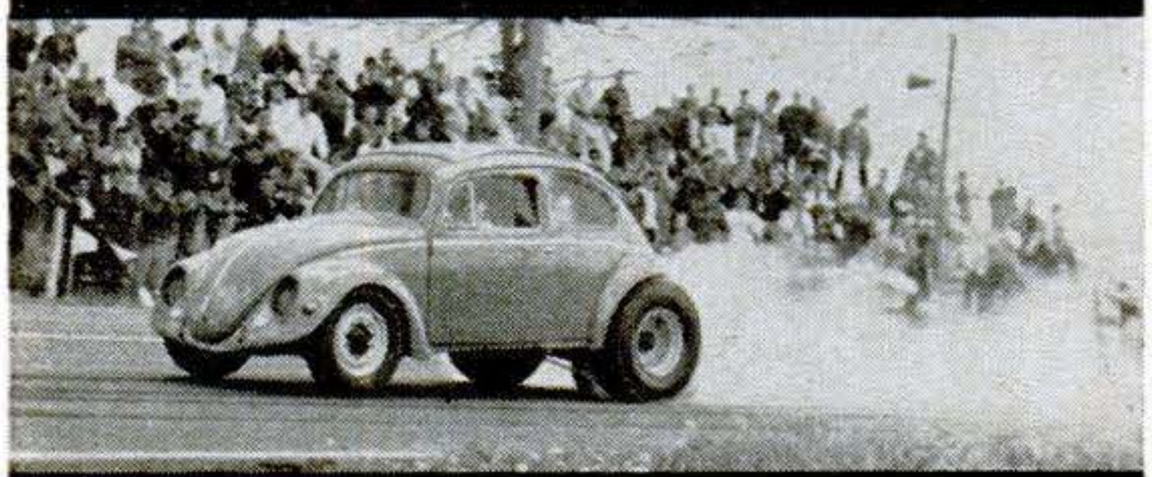

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When Stock Cars Don't Finish . . .

Our shoes are stainless steel, instead of the mild steel in your own car.

We're not allowed blowers under the rules, so we duct a lot of air into the drums.

More and more race-car owners are coming around to power brakes. With power brakes, a driver can wait a little longer, on those short tracks, to push the brake pedal and still get around a corner.

Disks? Now you've got something. The stock-car rules ban disks unless they are standard equipment. But beginning with the '68 models, you can't get power brakes in a Ford with drums. You've got to buy disks. I hope this is a trend. Disks get rid of heat better than drums. Disk pads have a short life, but I think that can be whipped by increasing the number of pads per disk.

Tires: a lesson for everyone. Finally, something happens with tires in stock-car racing that can hold a lesson for Mr. Average Motorist. The cornering power of a tire is directly proportional to its temperature. You may think that a racing driver would have a hard time telling when his tires were getting too hot. He doesn't, though. When his rubber begins overheating, he begins losing lateral stability—he slides more in the corners.

Let's say he has been going into a corner at 6,500 r.p.m. He's got his "groove." He has been coming out of his corner at 6,300. Now he goes in at 6,500 and loses 300 coming out. He can't put his throttle back down where he did before because he is getting oversteer—or maybe understeer, and he begins to lose the back end. Or he turns his steering wheel and the car won't respond as it should. This is his tipoff. His tires are too hot.

When a tire temperature gets around 300 degrees, it becomes a whole new tire. A good driver at that point gladly gives first place to anyone who wants it.

And what's this got to do with you, the average motorist? Let me tell you. When you get out on one of these superhighways and begin rolling it for two or three hours at the speed limit on a blistering hot day, your tires begin to get unstable, too. You can feel it in your wheel. I have. PS

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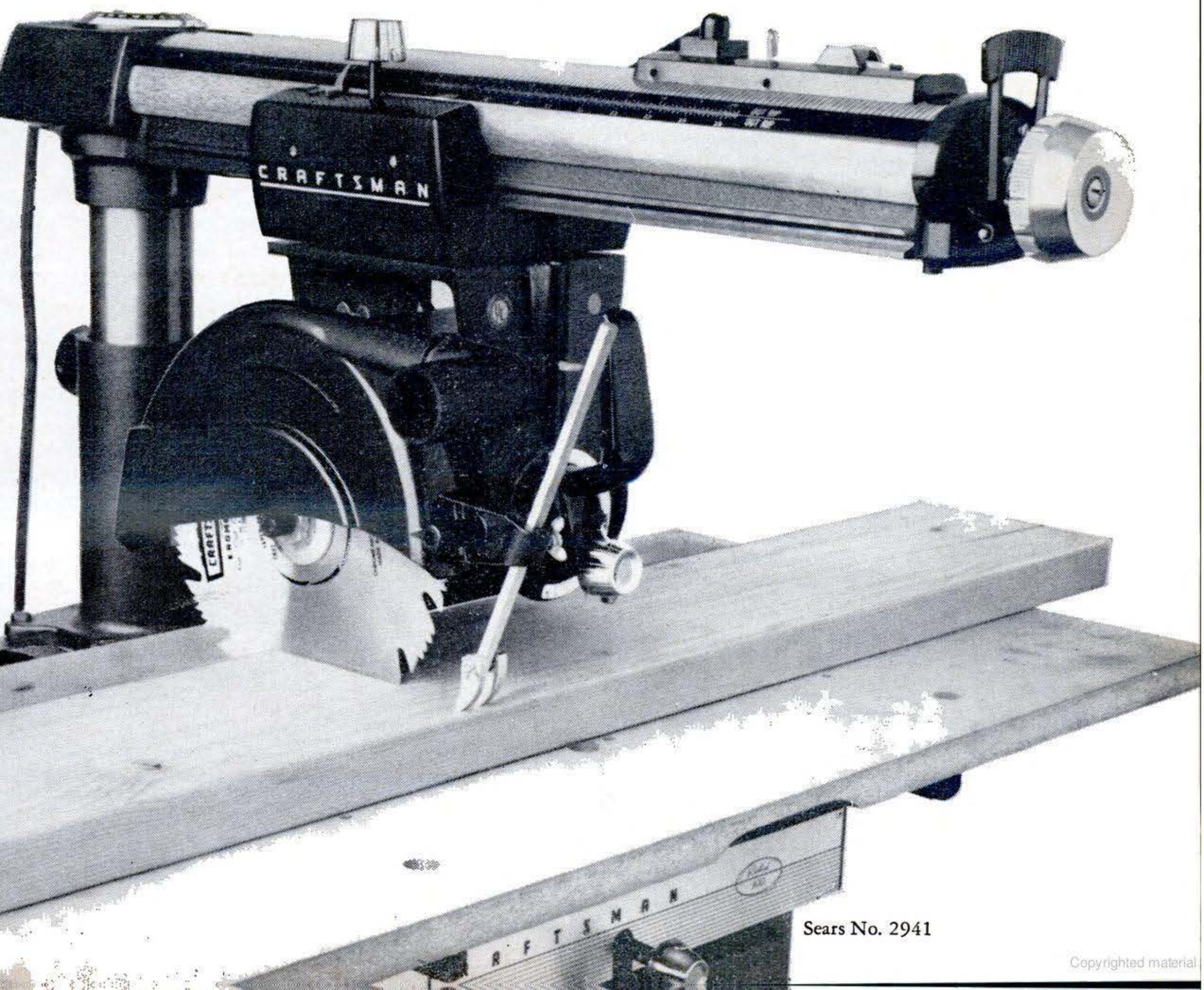

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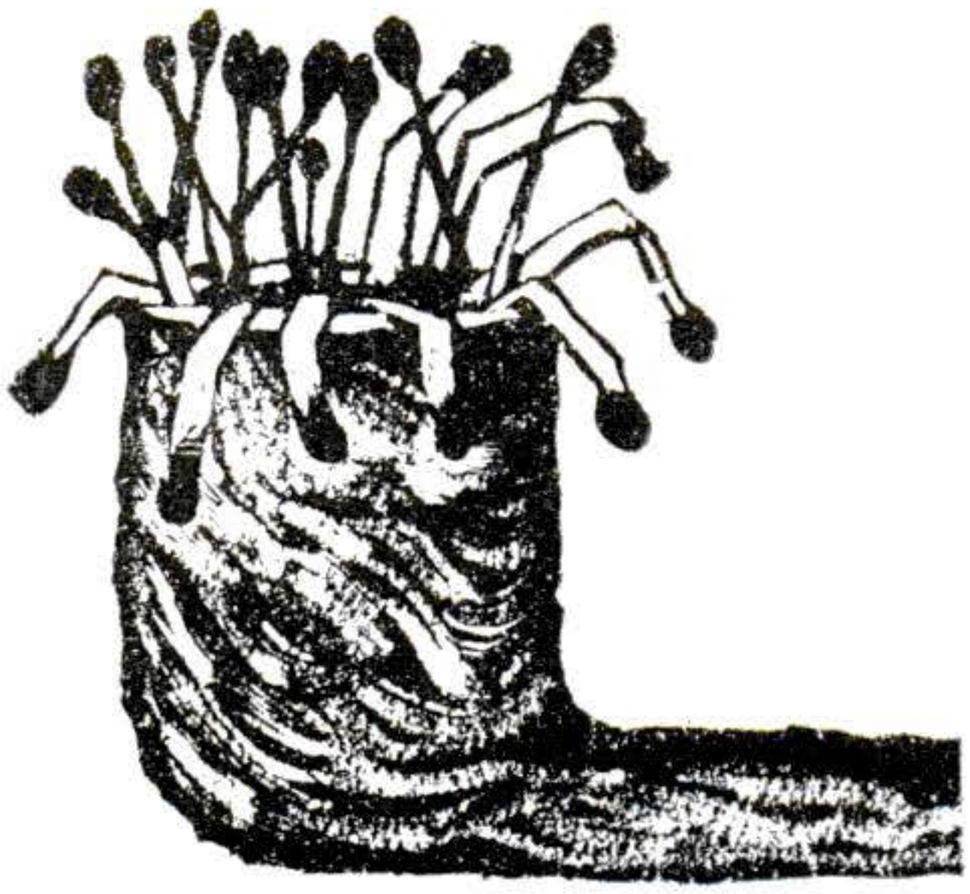

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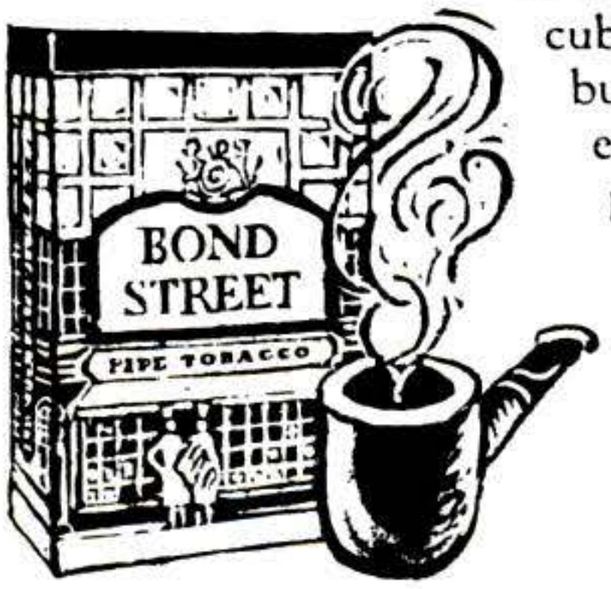

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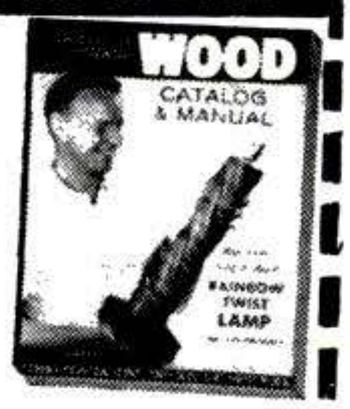

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Could It Happen Again?

[*Continued from page 73*]

a motorcade route. Recognizing the impracticality of attempting a check of all buildings and the thousands of windows along a route that runs for several miles, the Commission recommended that the more obvious danger points be investigated. None of the buildings along the 10-mile route in Dallas were checked.

Helicopters, now employed, enable Secret Service men to keep an eye on roofs of high office buildings and on high-level windows that could not be observed easily from the ground.

Mr. Johnson has a well-known penchant for secrecy and surprise, and the more secretive he is about his travels, the better the men assigned to protect him like it. For obvious reasons, secrecy can be the most effective weapon of all in guarding a President. A number of trips since the assassination were not announced until the President was practically en route or until he landed.

But in a democratic society, the President, as the Warren commission observed, "must go to the people. Exposure of the President to public view through travel among the people of this country is a great and historic tradition of American life."

Given that condition, the job of protecting the President will forever involve an element of chance, a degree of risk. As former Treasury Secretary Douglas Dillon, who headed a presidential commission supervising the Secret Service reorganization, told Congress:

"There is a certain physical danger, come what may. This is inherent in being President."

The element of chance was clearly present at the Glassboro, N.J., summit talks between Mr. Johnson and Soviet Premier Kosygin last June.

Several thousands had waited for hours through blistering heat and downpour for a glimpse of the two leaders. The front rank of the crowd, confined by a fence and a line of state troopers, was no more than 20 to 30 yards from the crest of the sloping lawn.

The crowd could not see the President and Kosygin emerge through the door. The Secret Service no doubt would have preferred that the two climb into cars

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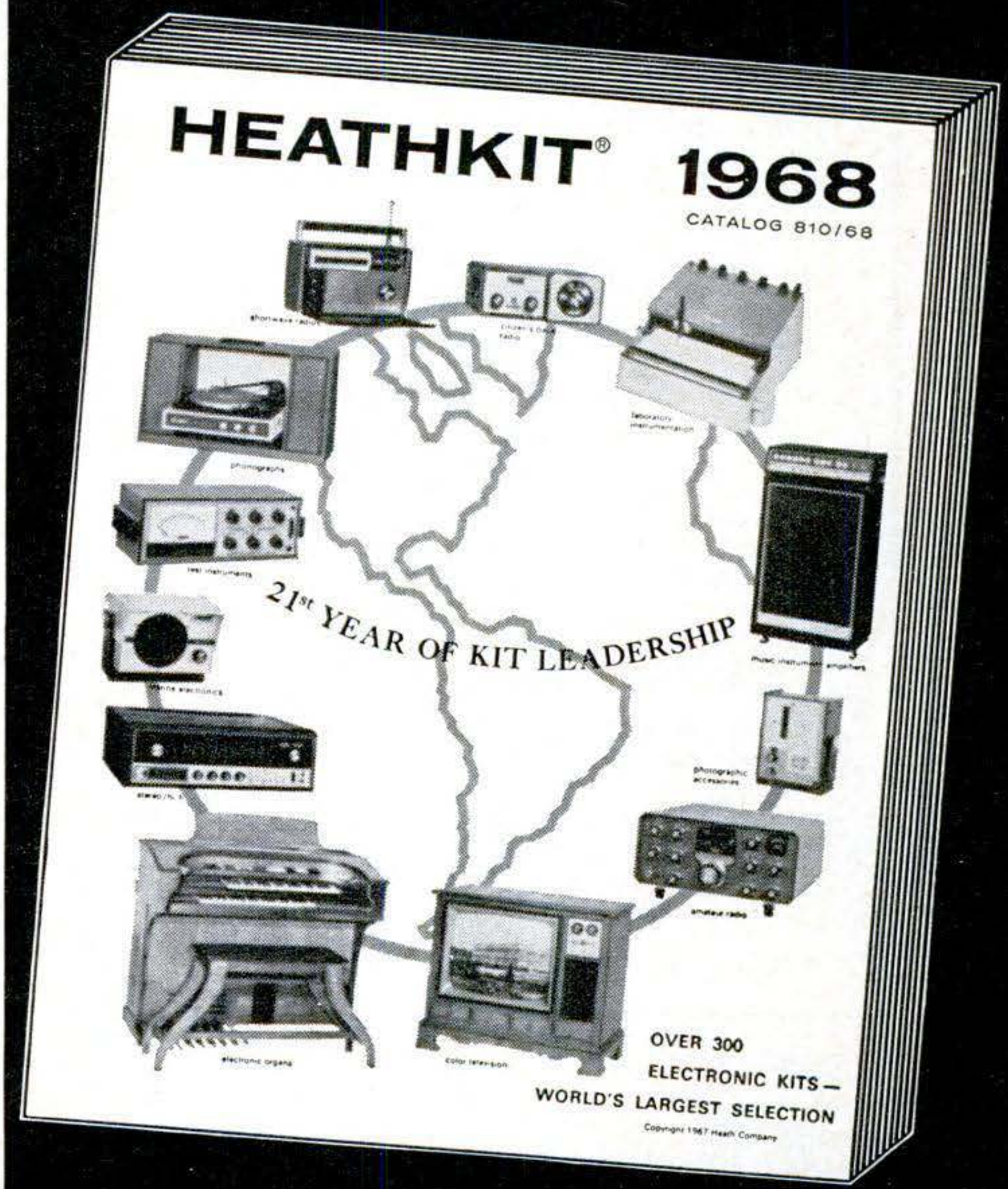

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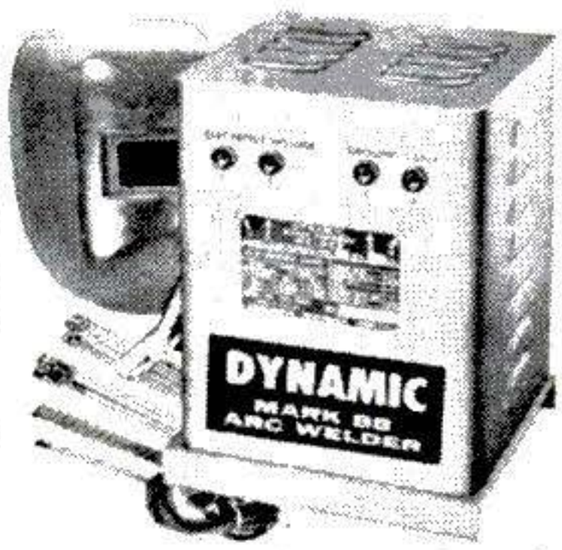

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Could It Happen Again?

and drive off immediately. Kosygin, in fact, began to enter his car after he and the President shook hands. But then Soviet Ambassador Dobrynin made a little-noticed move—to gratify the crowd—and increased the security risk.

The Secret Service could not interfere, of course, as Dobrynin took hold of Kosygin's arm and whispered in his ear. Kosygin smiled and nodded, stepped back out of the car, and headed for the crowd. Mr. Johnson followed quickly.

The crowd roared as they appeared. The two leaders spoke for several minutes. Troopers and Secret Service men (some agents were spotted in the crowd all day) watched tensely. A rifle could not have been concealed in that shirt-sleeved crowd; a small pistol *could*. Then the two leaders were off. The moment of danger passed, the kind of moment that can never be entirely eliminated whenever a President travels.

The Secret Service doesn't have to be reminded of this as a presidential campaign year approaches, a time in which Mr. Johnson will feel compelled to "go to the people" more often. Such trips cannot be kept secret. And national political passions run deep over such issues as the Vietnam war and riots in the cities. From a security standpoint, the 1968 campaign will be a sensitive time.

The Service has plugged important gaps, but gaps will inevitably remain.

Since 1865, the Warren Report noted, four Presidents have been assassinated, (Lincoln, Garfield, McKinley, Kennedy) and attempts have been made on the life of a President (Truman), a President-elect (Franklin D. Roosevelt), and a presidential candidate (Theodore Roosevelt). It should be noted that the Secret Service was assigned the task of protecting Presidents only after McKinley's assassination in 1901.

The Commission admittedly could recommend no procedures to provide the impossible—that is, "guarantee security." It did ask for reforms that would "result in a lessening of the danger."

Could it happen again? The answer would have to be "yes." On the other hand, because of the important changes since Nov. 22, 1963, we might say, "yes, but it's far less likely." That much appears to have been accomplished. PS

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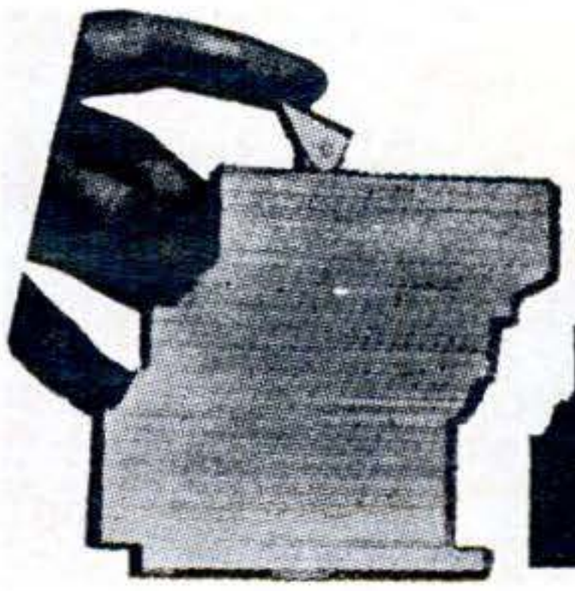

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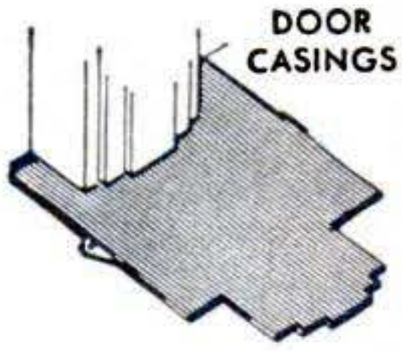

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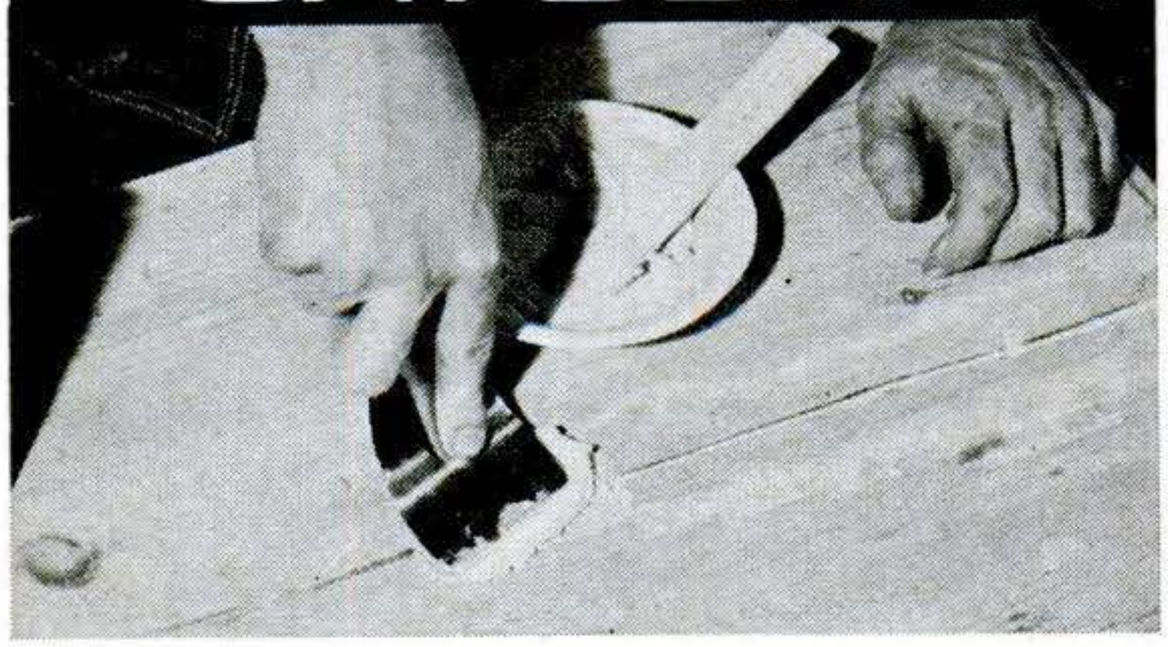

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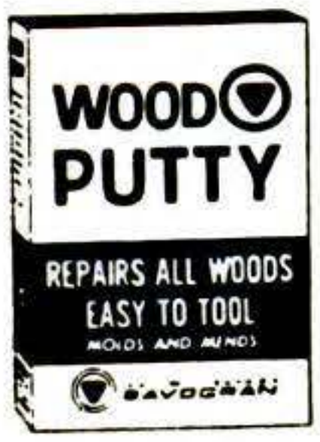

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The Lively '68 Snowmobiles

[Continued from page 83]

wide-track models (manual start, $1,125; electric start, $1,255) reverse transmission is standard equipment.

All three Skeeters are 50 percent quieter, Evinrude says. A new dual muffler system, helped out by baffling within a new enclosed engine compartment, does the trick.

And one that purrs. Arctic Cat has introduced a kitten—the compact Cougar. This one comes with either an eight-hp. four-cycle or 372cc. two-cycle engine. The Cougar has a conventional bogie-wheel suspension for the drive track.

The expanded Arctic Cat "Panther" series has the unique torsion-spring suspension system instead of bogie wheels. Last year's Arctic Cats were the first to have the spring suspension, and the company says it was successful. The big advantage: It cuts bottoming on rugged trails and allows you to adjust the tension for light or heavy loads. The Panthers come with five engine options: a 12-hp. four-cycle, and 299cc., 372cc., 492cc., and 598cc. two-cycle power plants.

AMF this year is showing an expanded line of Ski-Daddlers. They've added two new Super Scouts, the Mark II and Mark III, with optional electric starters. All five Ski-Daddlers have a handlebar of new design that makes steering easier. The Ski-Daddlers have been strengthened all around to withstand rugged use. Prices of the AMF machines range from $800 for the Sno-Scout to $1,400 for the wide-track model.

Larson has given its tough birds, the Falcon, Hawk, and Eagle, a "sports-car look," accenting their blue with a black racing stripe. The new Larsons have been reinforced at stress points to strengthen the chassis. The Falcon ($835) comes with a 292cc. JLO engine. The Hawk ($995) has a 297cc. JLO engine. The big Eagle has a 372cc. JLO engine and sells for $1,155.

Sears, Roebuck enters the snowmobile business in a big way, this year, with two models: wide-track and standard-track. The 20-inch-track Wildcat XSR 2000 has a 20-hp. electric-start engine that gives it a top speed of 40 m.p.h. It's $1,095. The 15-inch-track XSR 1500 with 15-hp. engine costs $849.

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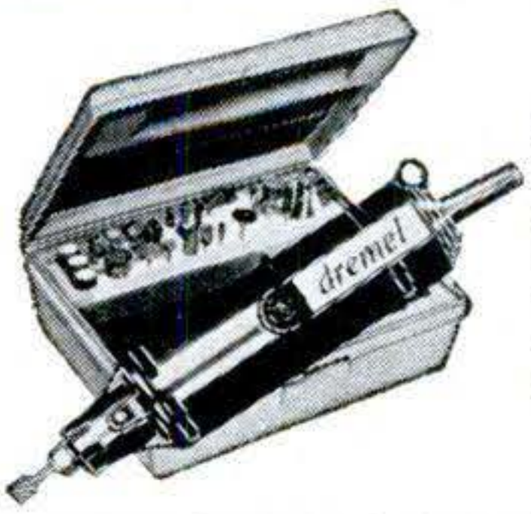

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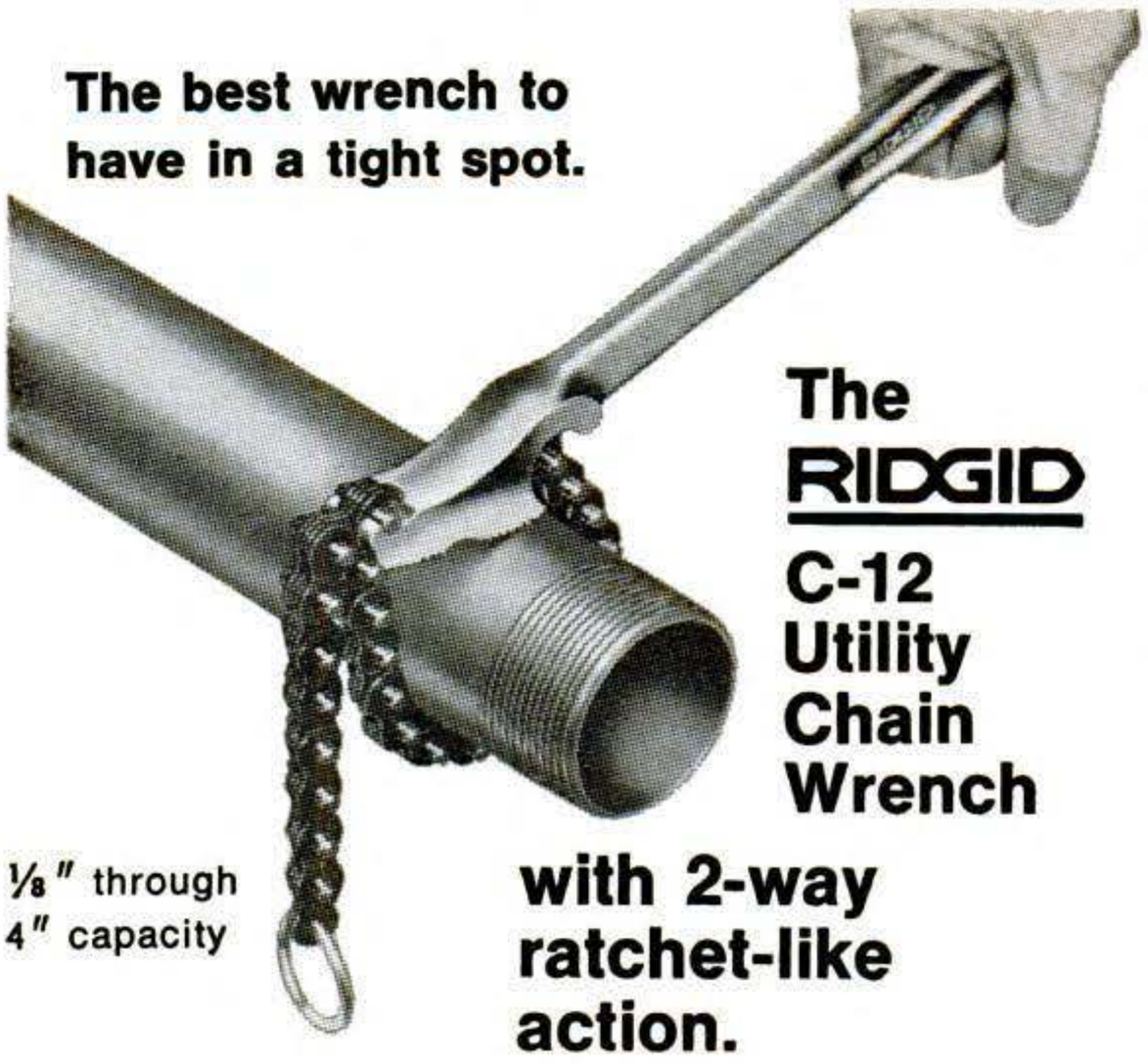

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The Lively '68 Snowmobiles

The three Kings. Yukon King has three new models—Husky, Grizzly, and Kodiac. The little Husky with a 247cc. 10-hp engine can whizz over the white stuff at 35 m.p.h. The Grizzly and Kodiac offer a choice of a 292cc., 15-hp. JLO engine or a new 386cc., 20-hp. power plant of die-cast aluminum.

Moto-Ski gives you a wide choice of engines for all kinds of snowmobiling fun. Their Cadet has a 250cc. Hirth engine with a top speed of 30 m.p.h. Other Moto-Ski models offer engine options up to 375cc.

The '68 Alouettes carry a 20-hp. Sachs engine with a top-performance capability of 45 m.p.h. The standard Allouette lists at $895; the electric-start model, $1,025.

Bobsled styling marks the Fox Trac line. There's a new wide-track model that offers you the option of a 297cc. or 372cc. JLO engine. The standard Fox Tracs have 29 new features, including a stronger rubber track, reinforced with steel cable.

If you encounter any frigid tigers anywhere in the snow belt this winter they'll probably be Trade Winds snowmobiles. Trade Winds is marketing the Tiger with 246cc. and 300cc. Hirth engines. They also have a Super Tiger with engine options from a 297cc. JLO to a 372cc. Hirth. The Trade Winds Cheetah has 594cc. JLO with electric start as standard. Prices range from $795 to $1,450.

One of the more unusual snowmobiles on the market is Bolens Diablo Rouge. This is an articulated vehicle powered by a 16-hp. Hirth engine. The two-section machine has great stability, yet it can put snow behind it at a 35-m.p.h. clip.

We've just sampled the approximately 40 makes of snowmobiles around this season. About 150,000 will be sold this year, bringing the number in use to about 350,000.

North Americans will spend about $150 million on machines, another $20 million on equipment and clothing to make snowmobiling more comfortable.

These figures show that it's not a kiddie pastime. The sport is really growing up as more sportsmen discover this man-sized way to enjoy the winter. PS

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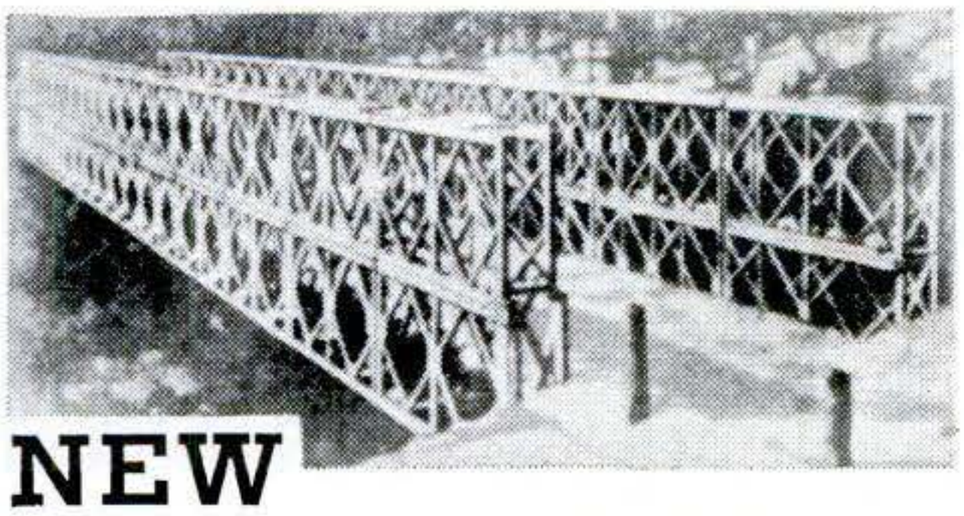

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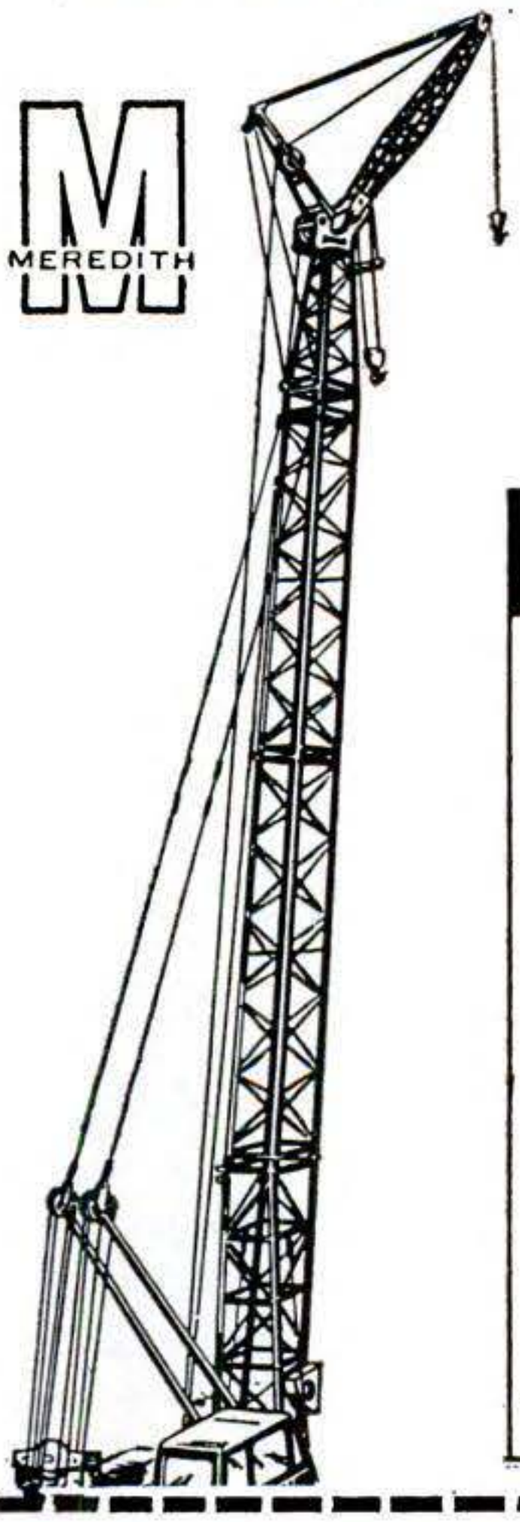

BRUSH IT ON. Let stand a few minutes or several hours depending upon the depth of the rust.

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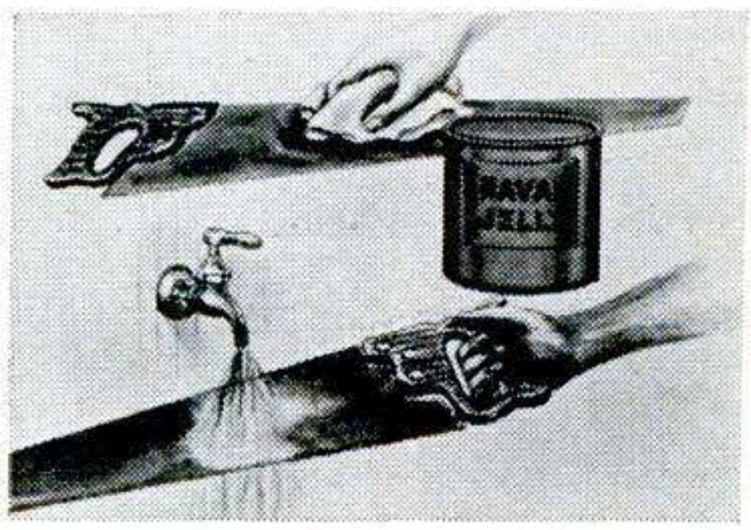

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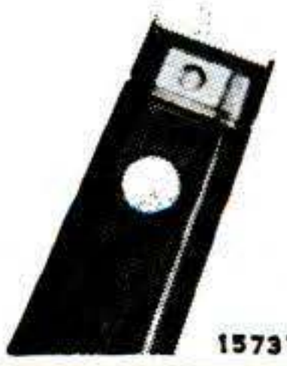

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Taking Care of the Electrical System

[Continued from page 105]

circuit output. The regulator must b adjusted to permit a maximum chargin voltage slightly higher than battery vo age. Generators usually use a three-uni regulator: voltage limiter, current limite and reverse-current cutout. The reverse current cutout prevents battery curren from running the generator as a moto when battery voltage is higher than gen erator output voltage, as when the engin is not running.

The alternator. Many cars use an alte nator (sometimes called an AC genera tor) in place of a generator. Basically, generator holds the fields stationary an rotates the armature. The alternato holds the armature stationary and ro tates the fields. The differences in desig and the relative masses involved permi the alternator to put out at lower engin speeds than a generator, making it a mor efficient charging device for low-speed stop-and-go driving.

An alternator in a typical late-mode car uses diodes to rectify AC to DC, sinc a battery can only be charged with DC A diode permits current flow in one direc tion only. Several are used to convert th AC from the alternator to the DC neede by the battery.

Because current can flow in only on direction, no reverse-current cutout is re quired. Also, the amperage of an alterna tor is self-limiting, so no current limite is used. An alternator, then, require only a voltage limiter.

Accurate charging-circuit-output tes and adjustments call for special equip ment and know-how. You can, howeve get a pretty good idea of charging-circu output by use of a $3 inductance mete The meter slips over the generator-alte nator output wire—no mechanical con nections are required—to indicate outpu on a calibrated scale. For best readin turn on the headlights for about fiv minutes before starting the engine an positioning the meter. Immediately afte starting, particularly on alternators, th meter will read full charging-circuit ou put. Generators will have to be turne at considerably higher engine speeds t get full output. The rate will taper off a the battery becomes charged.

You can, of course, get an idea o

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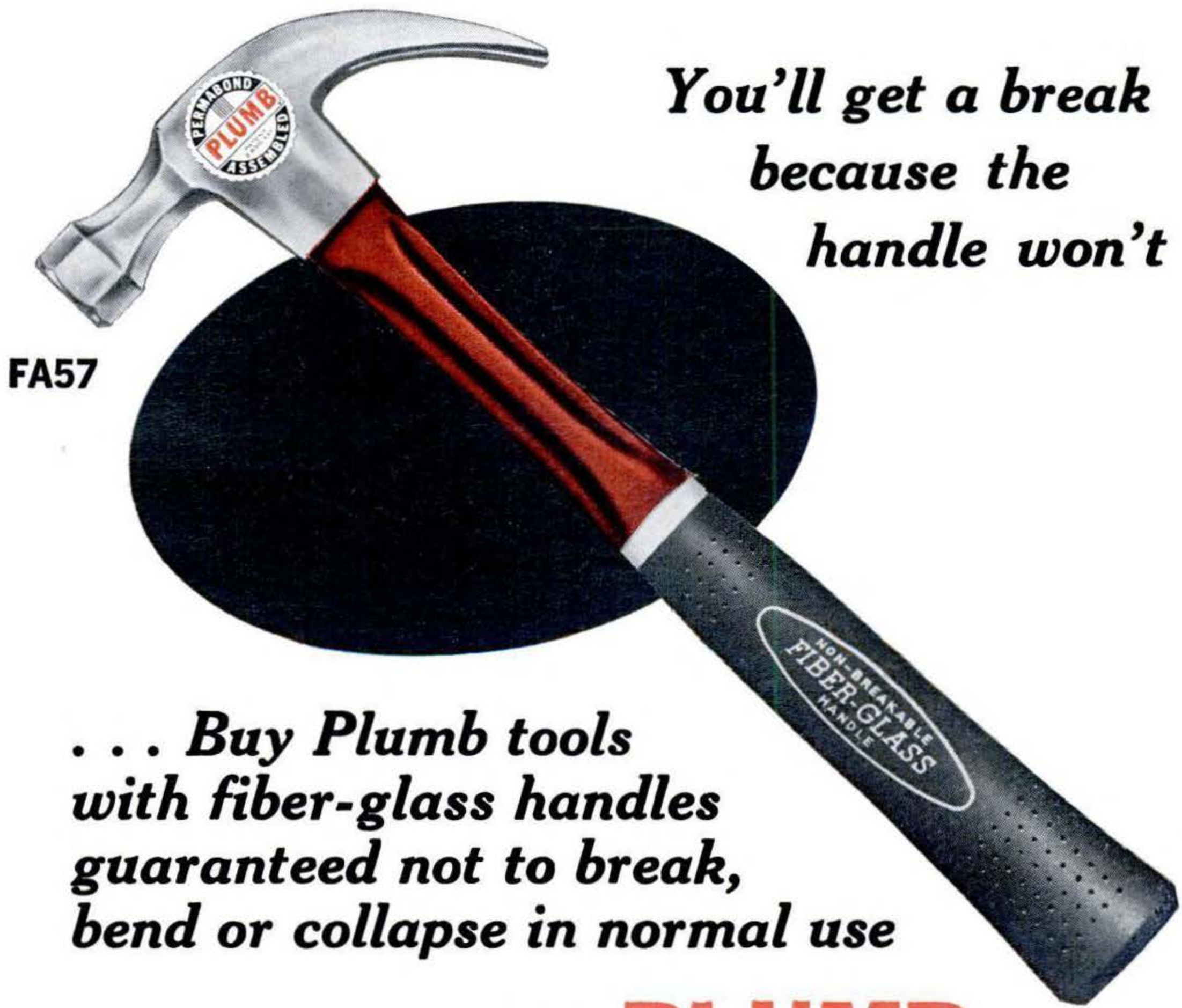
what's going on in your charging circuit by observing the idiot light or the ammeter mounted on your instrument panel. The inexpensive inductance meter, however, seems to do a better job.

Without a meter. If you don't have a meter you will know if your charging rate is too low because your battery will run down sooner or later and your starter will operate progressively slower. If your rate is too high, you'll be adding battery water at more frequent intervals, and you may be blowing light bulbs regularly. If you get repeated bulb failure, and if the blown bulbs show black deposits on the inside of the glass, it's a sure-fire indication of an excessively high charging rate.

Alternator service is virtually nil, although they can suffer wear. Generators require a few drops of light machine oil in the bearing-cap oiler once a month, and brush wear can be expected. Be very careful when booster-starting cars equipped with alternators. Always hook cables between batteries so that positive posts are hooked together and negative posts are hooked together. Failure to do so will apply voltage to the diodes in the direction opposite to that in which they can safely carry current. The result is diode damage and costly repair.

Well, now you're on your own. PS



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Man-Made Highway Hazards That Kill

[*Continued from page 88*]

rails and chain-link fence. The fencing has been used extensively in recent years, and does a remarkable job of cushioning a car and its occupants from what might otherwise be a fatal crash.

3. All unnecessary signs, curbs, barriers, and posts should be removed from gore areas. Where possible, more space should be provided for an off-the-road car to recover.

4. Bridge abutments and other roadside structures should be located farther from the right shoulder and protected with guardrails. Supporting pillars within the median should be similarly protected. Narrow bridges should be widened, curbs and safety walks avoided.

5. Slopes and ditches should be reshaped to give drivers every opportunity to regain control. Authorities now recommend much flatter slopes on embankments, cuts, and ditches.

Solid-concrete culvert walls—an obvious and unnecessary cause of accidents in recent surveys—can be eliminated by using longer drainage pipes at embankments, overpasses, and other locations.

6. We must plan highways to give the driver the best possible breaks—now and in the future when traffic will greatly increase. While it is certainly more economical in the short run to build roads with medians of less than 60 feet—the minimum width currently considered desirable—in the long run it will prove many times more costly in terms of accidents and lives lost.

Too often our interstate highways are designed around minimum standards, both in terms of safety and capacity. The result is an increasing accident and death toll as the roads become congested almost from the time they are first opened to traffic.

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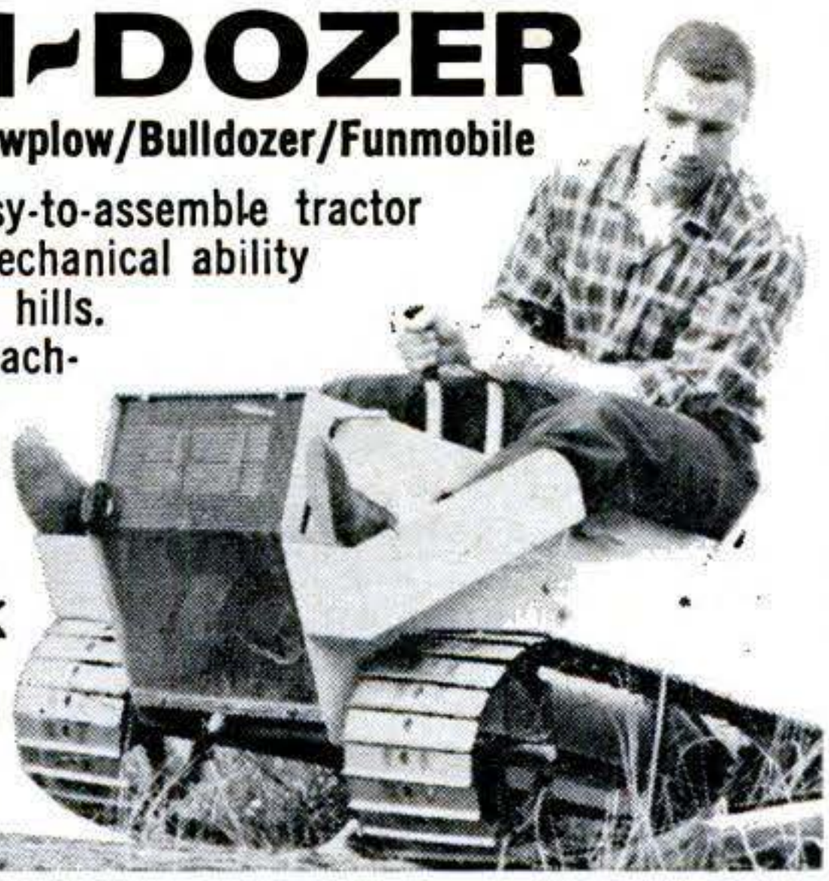

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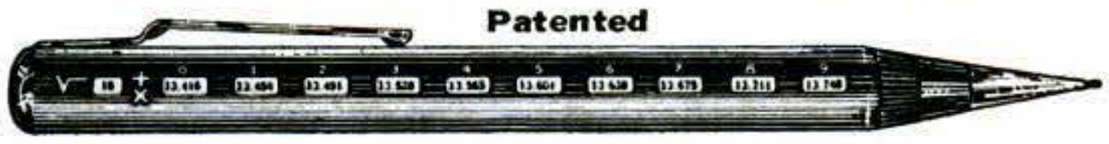

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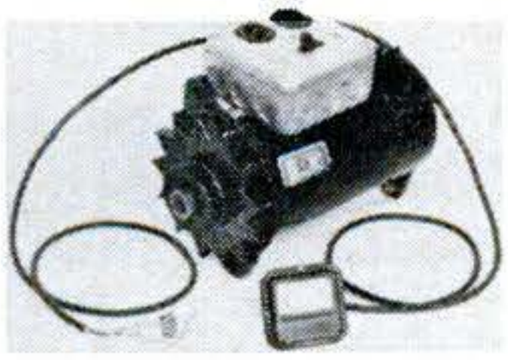

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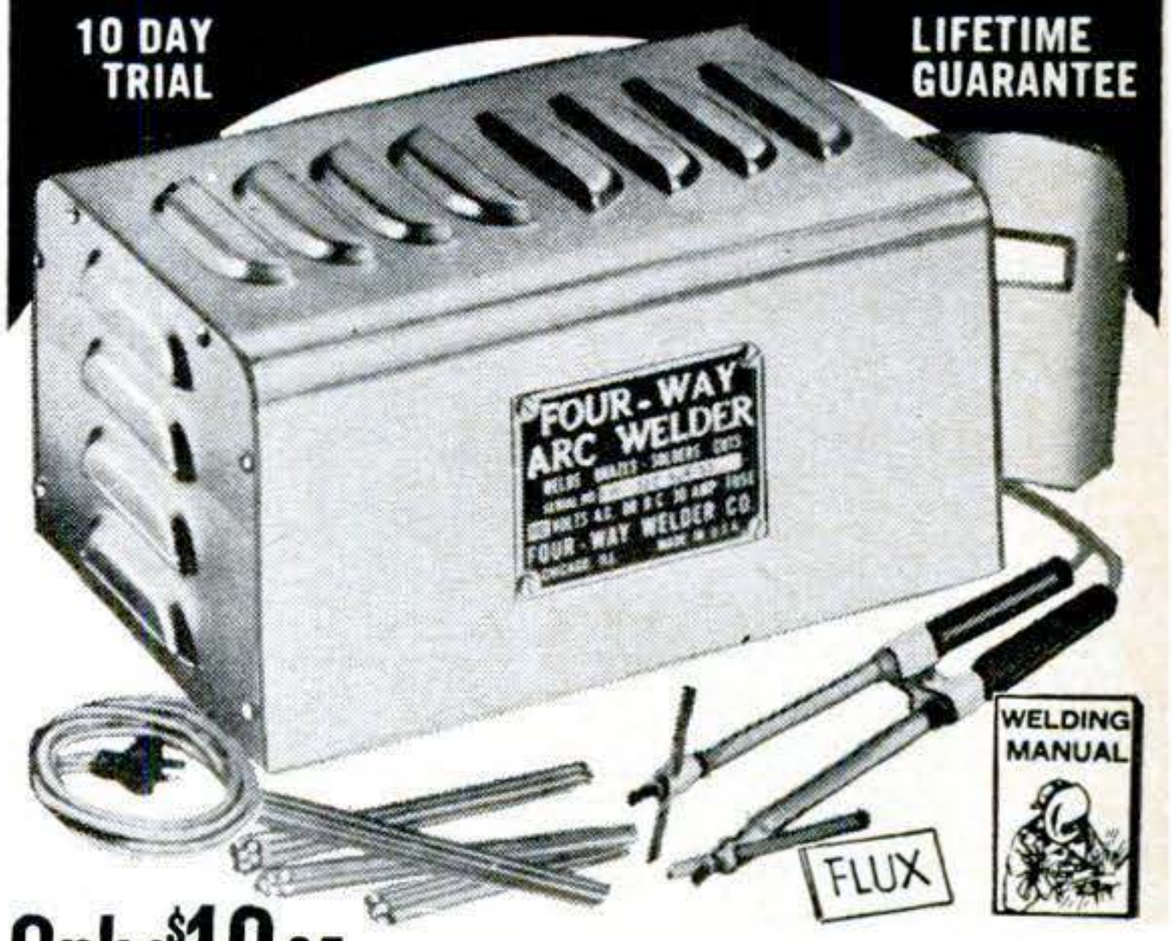

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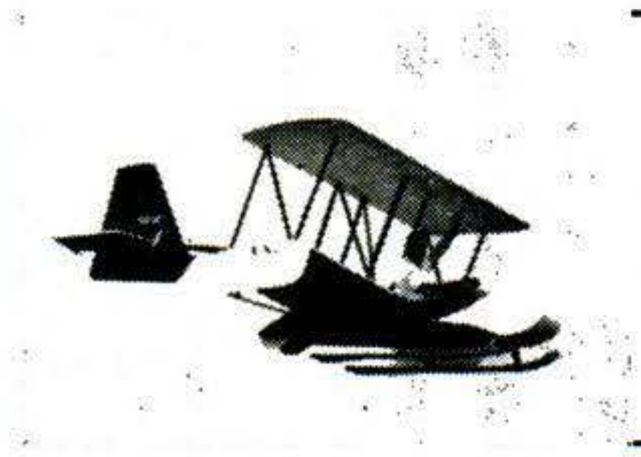

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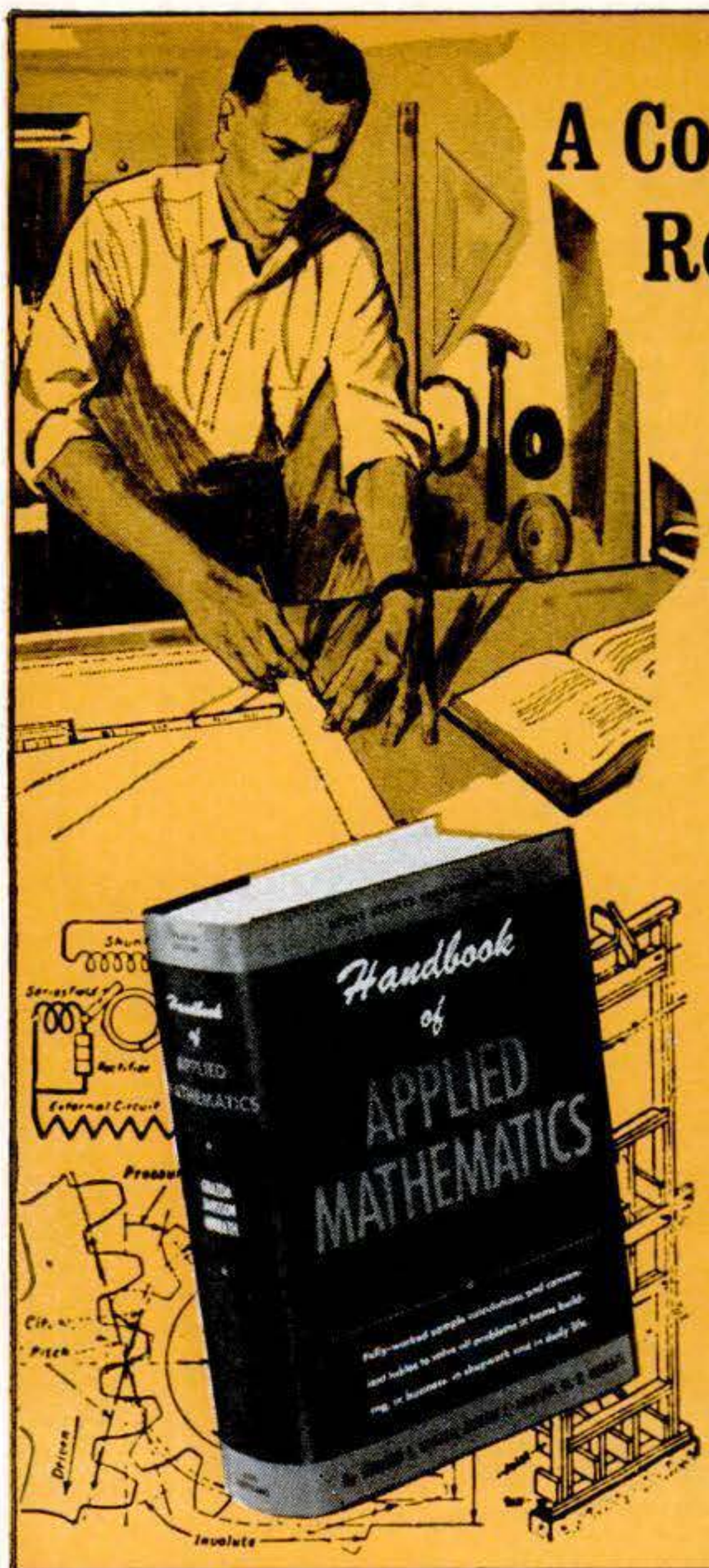

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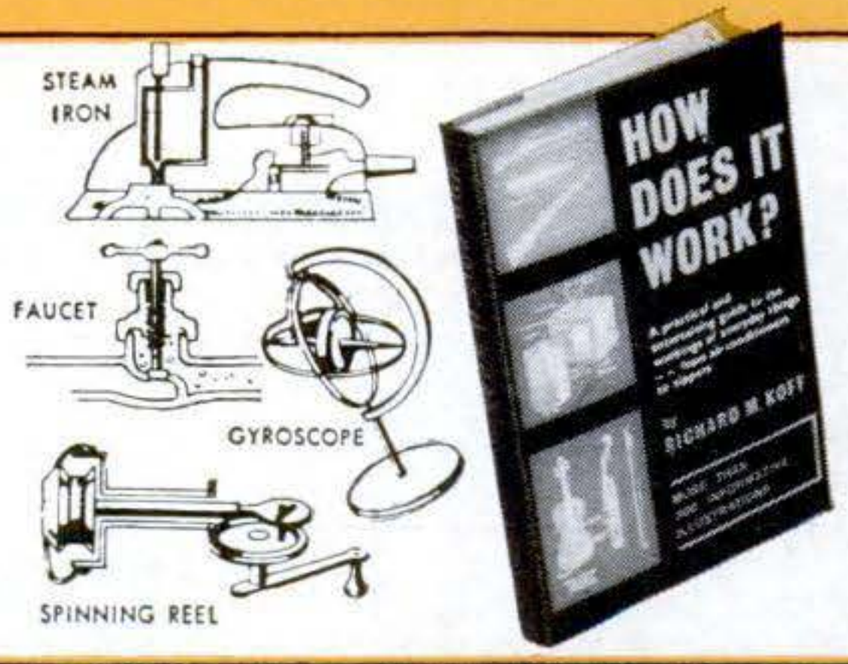

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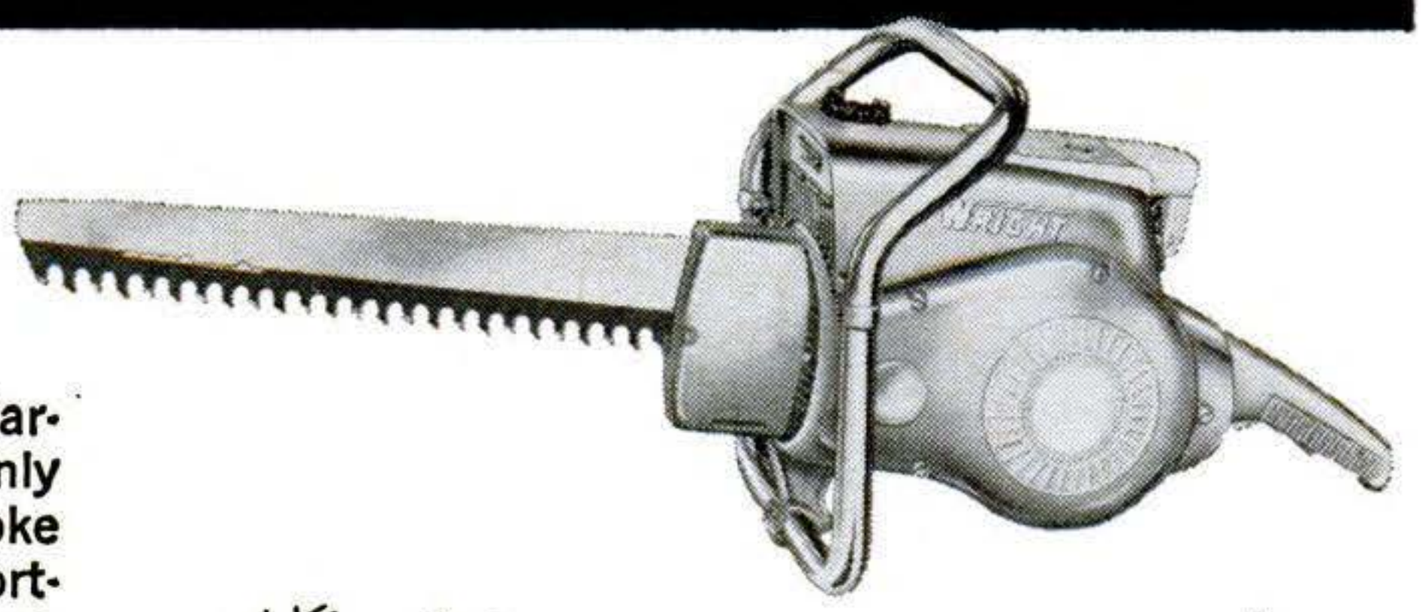

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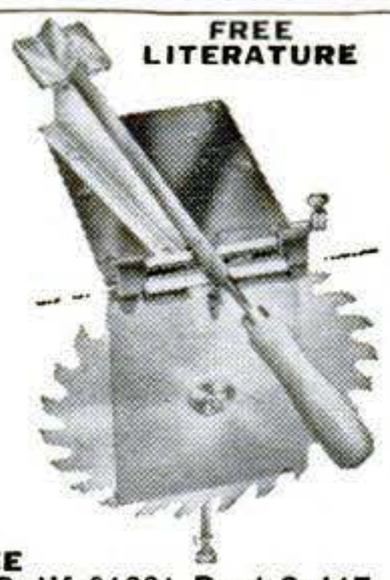

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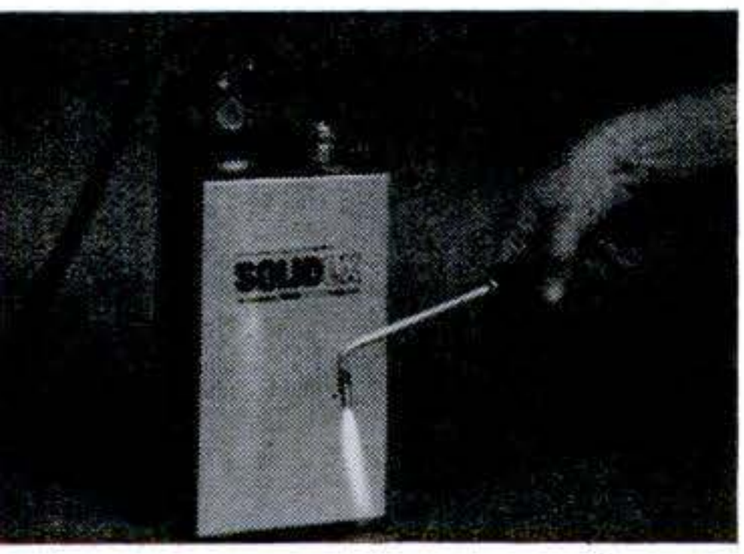

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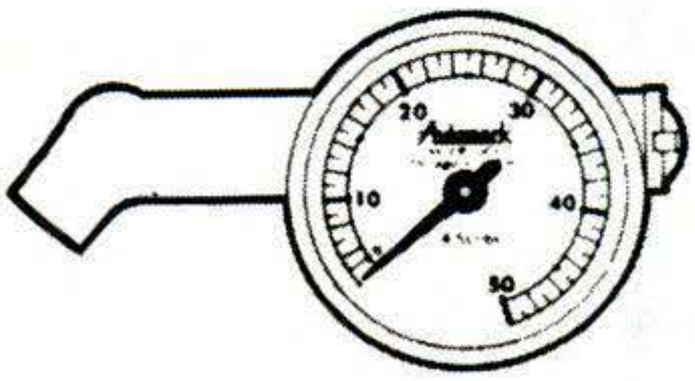

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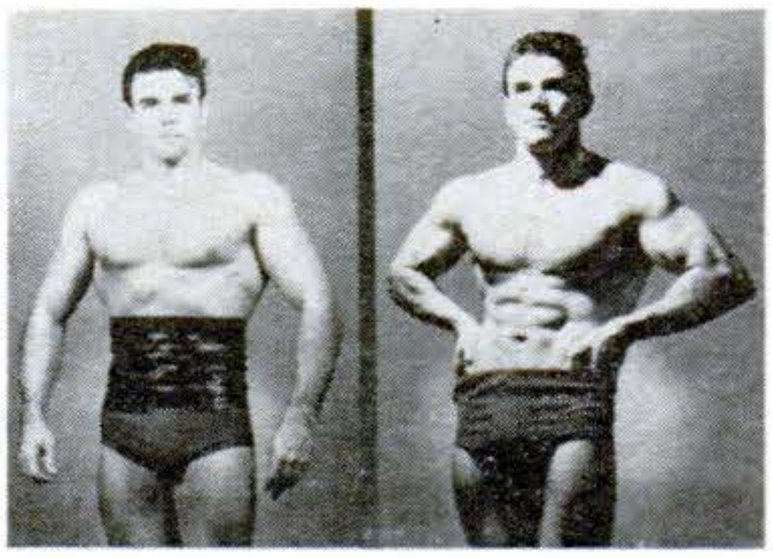

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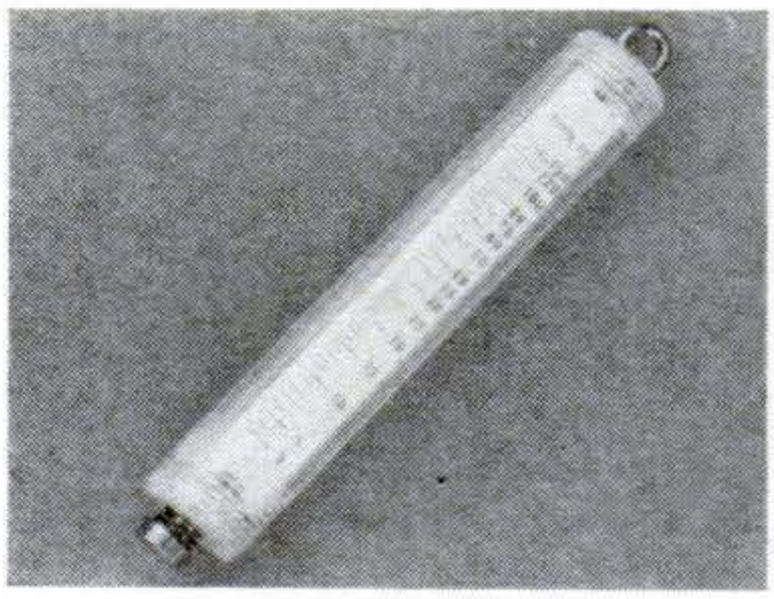

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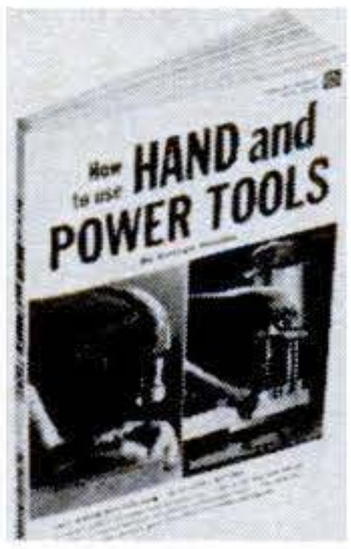

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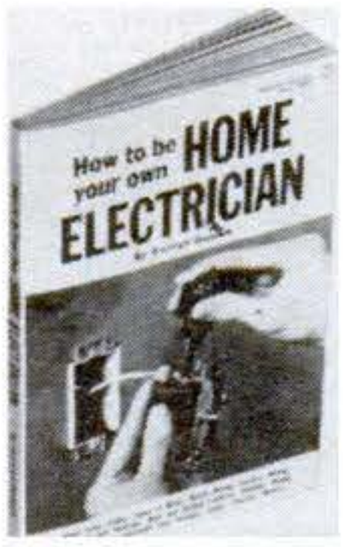

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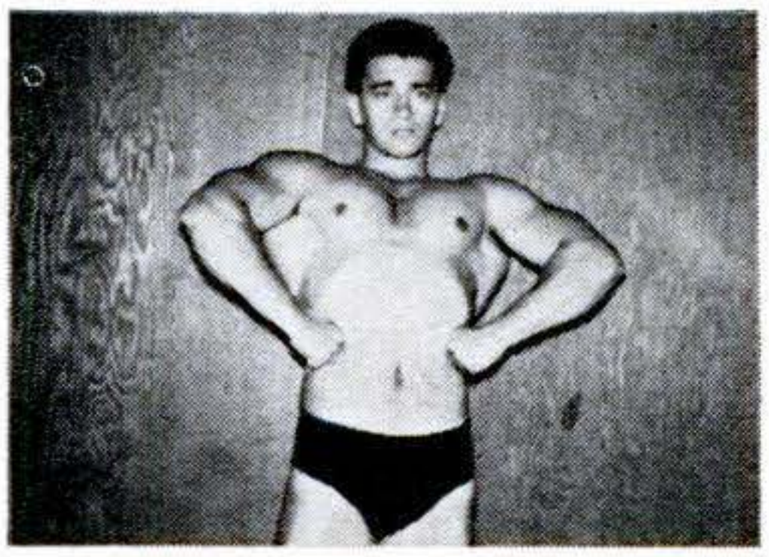

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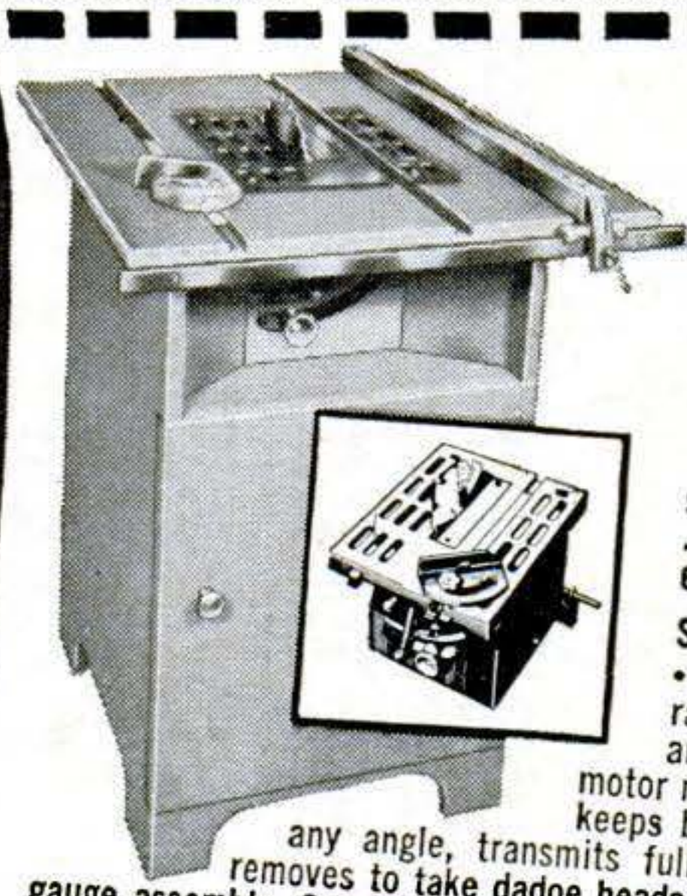

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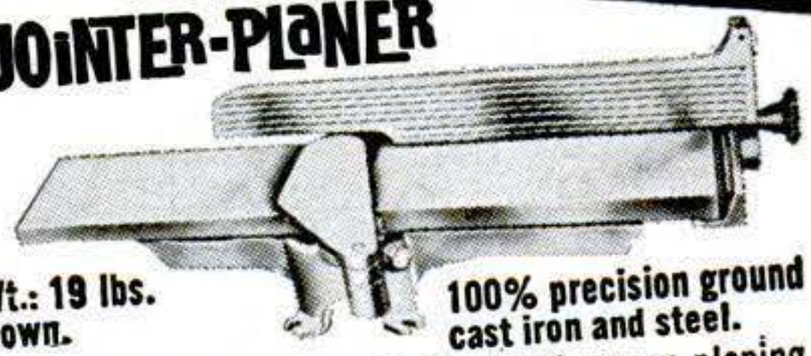

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100% precision ground cast iron and steel.

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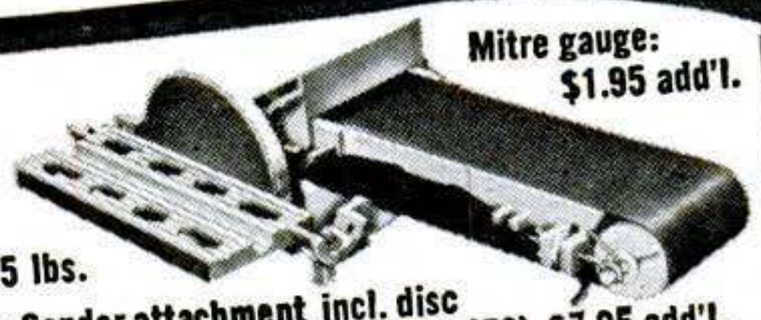

Mitre gauge: $1.95 add'l.

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$14.95 †Disc Sander attachment incl. disc bracket, ground cast table (tilts 0-45°): $7.95 add'l.

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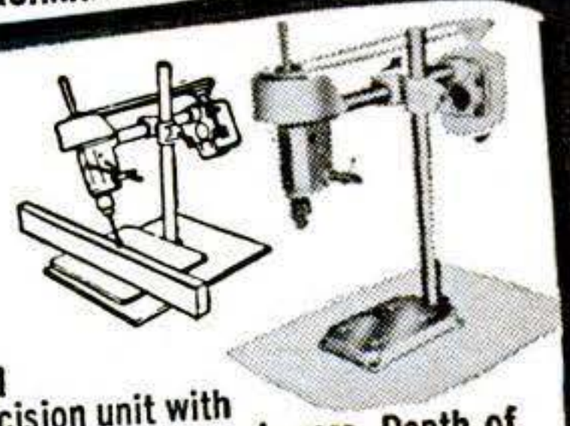

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Jacob's chuck incl.

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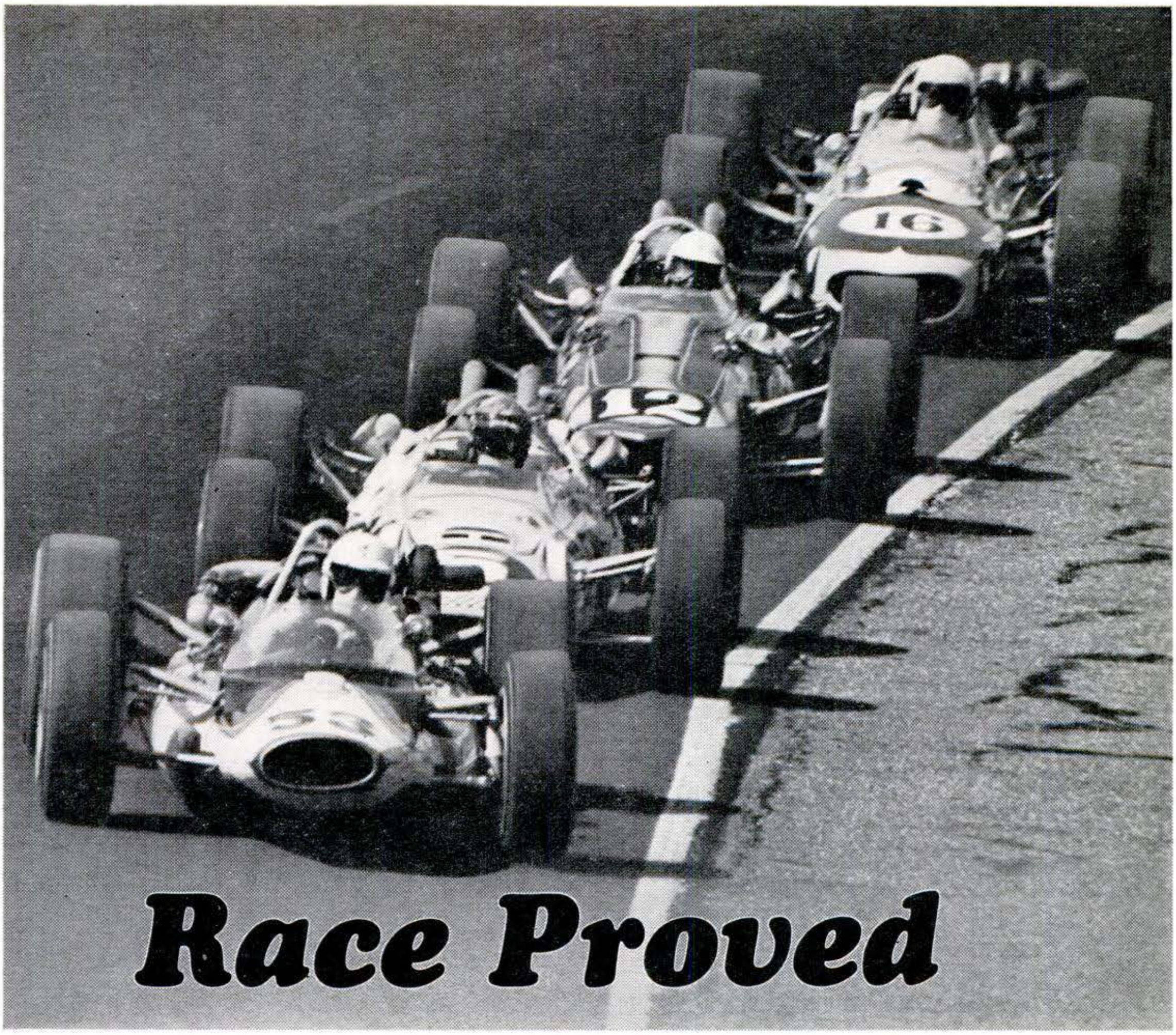

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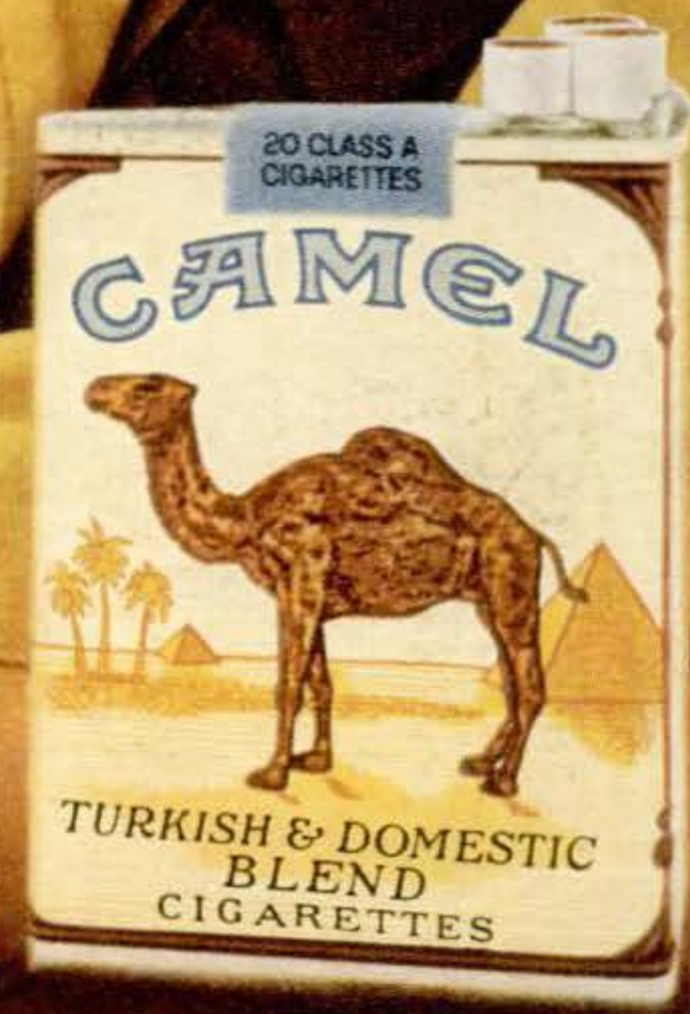

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